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ETSI STANDARD

Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (Power, Cooling and environment systems used in telecommunication networks); Part 11: Battery system with integrated control and monitoring information model

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Foreword

This final draft ETSI Standard (ES) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the ETSI Membership Approval Procedure.

The present document is part 11 of a multi-part deliverable covering Monitoring and control interface for infrastructure equipment (Power, Cooling and environment systems used in telecommunication networks), as identified below:

Part 1: "Generic Interface";

Part 2: "DC power system control and monitoring information model";

Part 3: "AC UPS power system control and monitoring information model";

Part 4: "AC distribution power system control and monitoring information model";

Part 5: "AC diesel back-up generator system control and monitoring information model";

Part 6: "Air Conditioning System control and monitoring information model";

Part 7: "Other utilities system control and monitoring information model";

Part 8: "Remote Power Feeding System control and monitoring information model".

Part 9: "Alternative Power Systems";

Part 10: "AC inverter power system control and monitoring information model";

Part 11: "Battery system with integrated control and monitoring information model";

Part 12: "ICT equipment power, energy and environmental parameters monitoring information model".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Use of modal verbs

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The present document was developed jointly by ETSI TC EE and ITU-T Study Group 5. It is published respectively by ITU and ETSI as Recommendation ITU-T L.1397 [i.5]. and ETSI ES 202 336-11 (the present document), which are technically equivalent.

1 Scope

The present document applies to Battery unit and Battery Systems with integrated control and monitoring for telecommunication and datacom (ICT) equipment. It applies to battery systems with a dedicated monitoring and control unit.

The present document defines:

- Monitored and controlled battery system architectures.
- The minimum set of exchanged information required at the interface, described in "natural language" in text tables. Battery autonomous protective circuitry without communication, self protection.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references,only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found in the ETSI docbox.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI ES 202 336-1: "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks) Part 1: Generic Interface".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references,only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

[i.1] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (dc)".

[i.2] ETSI EN 300 132-3: "Environmental Engineering (EE); Power supply interface at the input of Information and Communication Technology (ICT) equipment; Part 3: Up to 400 V Direct Current (DC)".

[i.3] ETSI TS 103 553-2: "Innovative energy storage technology for stationary use – Part 2: Battery".

[i.4] ISO/IEC 10164 (all parts): "Information technology - Open Systems Interconnection".

[i.5] Recommendation ITU-T L.1397*:* "Monitoring and control interface for infrastructure equipment (Power, Cooling and environment systems used in telecommunication networks) - Battery system with integrated control and monitoring information model".

[i.6] Recommendation ITU-T L.1221: "Innovative energy storage technology for stationary use – Part 2: Battery".

[i.7] IEC 60050-482: "International Electrotechnical Vocabulary – Part 482: Primary and secondary cells and batteries".

[i.8] IEC 62620: "Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for use in industrial applications".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

NOTE: Terms referring to energy interface, equipment and distribution are described in power distribution standards ETSI EN 300 132-2 [i.1] and ETSI EN 300 132-3 [i.2].

accumulator cell: cell where electrical energy is accumulated by electrochemical reactions between the negative electrode and the positive electrode

NOTE 1: As in ETSI TS 103 553-2 [i.3].

NOTE 2: Adapted from IEC 60050-482 [i.7] and IEC 62620 [i.8].

alarm: any information signalling abnormal state, i.e. different to specified normal state of hardware, software, environment condition (temperature, humidity, etc.)

NOTE 1: As in ETSI ES 202 336-1 [1].

NOTE 2: The alarm signal should be understood by itself by an operator and should always have at least one severity qualification or codification (colour, level, etc.).

EXAMPLE: Rectifier failure, battery low voltage, etc.

alarm loop: electrical loop which open or closed state correspond to alarm start (set) or end (clear) state

NOTE: As in ETSI ES 202 336-1 [1].

alarm message: text parts of the alarm structure

NOTE: As in ETSI ES 202 336-1 [1].

alarm structure: organized set of information fields in an alarm data frame (time stamp, set/clear, text, etc.)

NOTE: As in ETSI ES 202 336-1 [1].

Battery Management System Or Unit (BMS, BMU): electronic system associated with a battery which monitors and/or manages its state, calculates secondary data, reports that data and/or controls its environment to influence the battery's performance and service life and has the functions to cut off in case of abnormal conditions (e.g. over charging, over current and over heating and charge balancing between cells or parallel cells blocks)

NOTE 1: Depending on the application and its size, the function of the BMS/BMU can be assigned to the battery cell, module, string, pack or system and equipment using the battery. A common implementation is a BMS/BMU made of several electronic modules located at different levels of the system.

NOTE 2: A Battery Management System (BMS) is sometimes also referred to as a Battery Management Unit (BMU).

NOTE 3: As in ETSI TS 103 553-2 [i.3].

NOTE 4: Adapted from IEC 60050-482 [i.7] and IEC 62620 [i.8].

battery string: group of cells or battery modules of same technology and capacity connected in series to match the battery system voltage

NOTE 1: As in ETSI TS 103 553-2 [i.3].

NOTE 2: Strings can work in parallel with or without protective device (e.g. fuse or PTC) depending on the technology and safety risk.

battery system: system which incorporates one or more battery cells, modules, strings or battery packs and has one or more BMS or BMU

NOTE 1: As in ETSI TS 103 553-2 [i.3].

NOTE 2: Adapted from IEC 60050-482 [i.7] and IEC 62620 [i.8].

NOTE 3: The battery system is generally defined for high power and capacity batteries made of several battery strings or packs of blocks or modules it may include cooling or heating units and gas exhaust arrangement.

battery unit: energy storage system providing power to the telecom load comprised of a battery cell string

client post: any device (laptop, PDA, console, etc.) connected to servers via the operation system networks to perform maintenance or supervision operations

NOTE: As in ETSI ES 202 336-1 [1]).

Data Gathering Unit (DGU): functional unit used for several functions:

- collect serial, digital and analogue data from several equipment;
- option to send (output) serial or digital commands;
- forward/receive information to/from the Local/Remote Management Application via agreed protocols;
- mediation between interfaces and protocols.

NOTE 1: This function may be integrated as part of specific equipment.

NOTE 2: As in ETSI ES 202 336-1 [1].

Dynamic Name Server (DNS): associates a single domain name to an IP address

NOTE: As in ETSI ES 202 336-1 [1].

event: any information signalling a change of state which is not an alarm: e.g. battery test, change of state of battery charge

NOTE 1: The event signal should be understood by itself by an operator and should always have at least one severity qualification or codification (colour, level, etc.). It should be transmitted in a formatted structure with text message and other fields like for alarm, e.g. an event can be coded as an alarm with severity "0".

NOTE 2: As in ETSI ES 202 336-1 [1].

infrastructure equipment: power, cooling and building environment systems used in telecommunications centres and Access Networks locations

NOTE: As in ETSI ES 202 336-1 [1].

EXAMPLE: Cabinets, shelters, underground locations, etc.

Integrated Battery System (IBS): energy storage system providing power to the telecom load composed of one or several Integrated Battery Units (IBUs) connected to the DC bus and managed by an integrated control and monitoring usually called Master Battery Management Module (MBMM)

Integrated Battery Unit (IBU): energy storage system providing power to the telecom load comprised of a battery cell string integrated with a Battery Management System (BMS)

NOTE: The standard nominal IBU voltage is typically 24V or 48V comprised of one or more battery cell strings.

Master Battery Management Module (MBMM): electronic unit (optionally used depending on application) that manages and controls several connected Integrated Battery Units (IBUs) and provides safety control, communicating status and alarms, and data acquisition and history for the Integrated Battery System (IBS)

menu: list of possible input command choices that may be presented in different ways on a display

NOTE 1: Selection is normally made by a keyboard, a pointing device, a mouse or directly by finger on a sensitive screen.

NOTE 2: As in ETSI ES 202 336-1 [1].

object: class description of items that accept a set of properties or functions

NOTE 1: Generic objects can include more specific items and inherit from their properties. If correctly structured, object programming can allow the system to evolve, i.e. be more future-proof. The code should intrinsically be open and structured.

NOTE 2: As in ETSI ES 202 336-1 [1].

Systems Management Function (SMF): object properties or classes with projection on CMIS application context communication

NOTE 1: As in ETSI ES 202 336-1 [1].

NOTE 2: Set of ISO system management functions according to ISO/IEC 10164 [i.4].

warning: low severity alarm

NOTE: As in ETSI ES 202 336-1 [1].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

I_{Batt}	Total battery current (DC)
I_{IBn}	Integrated Battery Unit or System (IBU or IBS) current (DC) where *n* is the unit or system number
I_{Load}	Total output load current (DC)
I_{Rect}	Total rectifier output current (DC)

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Alternating Current
BMS	Battery Management System
BMU	Battery Management Unit
CAN	Controller Area Network
CMIS	Common Management Information Service
CU	Control Unit
DC	Direct Current
DGU	Data Gathering Unit
DNS	Dynamic Name server
DTD	Document Type Definition
HTML	Hypertext Transfer Make-up Language
HTTP	HyperText Transfer Protocol
IBS	Integrated Battery System
IBU	Integrated Battery Unit

ICT	Information and Communication Technology
IP	Internet Protocol
LAN	Local Array Network
LED	Light Emitting Diode
MBMM	Master Battery Management Module
NMS	Network Management System
PDA	Personal Digital Assistant
RMA	Remote Management Application
SMF	System Management Function
SoC	State of Charge

NOTE: Of the IBU or IBS.

SoH State of Health

NOTE: Of the IBU or IBS.

UPS Uninterruptable Power Supply

4 Battery solution with a dedicated monitoring and control unit

4.0 Introduction

In Information and Communication Technology (ICT) site, batteries are used to get an uninterruptible power supply. They are storing energy which is used to power equipment in the event of power source or power supply failure. Battery systems provide typical standby of 10 min to 48 hours on grid connected sites. For off grid telecom site, the battery autonomy can last several days

In most existing installations, there is no specific control/monitoring provided as part of the battery system. It is provided by the power system. With some new battery technologies, control and monitoring is incorporated in the battery unit.

The present document deal with battery solution with a dedicate monitoring and control unit.

Two type of solution is considered:

- Integrated Battery Units (IBU).
- Integrated Battery System (IBS).

Both an Integrated Battery Units (IBU) and an Integrated Battery System (IBS) store energy and deliver their stored energy when a power outage occurs, or on demand turn OFF the power source system e.g. during a battery test, like legacy battery unit, typically lead acid battery technology. The difference is that an IBU or IBS includes electronics combined with a battery string including several cells. In an IBU, the integrated electronics is referred to as the Battery Management System (BMS). In an IBS, an electronic unit may be optionally added to a system of connected IBU and this is referred to as the Master Battery Management Module (MBMM) to handle several multiple IBUs.

NOTE: For battery system architecture see ETSI TS 103 553-2 [i.3] or the technical aligned Recommendation ITU-T L.1221 [i.6].

4.1 Integrated Battery Unit (IBU)

An IBU includes electronics combined with a battery string including several cells. In an IBU, the integrated electronics is referred to as the Battery Management System (BMS).

Integrated in an IBU, the BMS includes the primary functions of safety protection, voltage limit detection and charge balancing, communicating status and alarms, and data acquisition and history. An IBU may include features like a resettable breaker or a replaceable fuse, internal heater depending on technology, electronic contactor and current regulation. Each IBU can communicate directly with an external management application by utilizing the appropriate transmission protocol (e.g. CAN bus) or/and a dry contact alarm signal. Figures 1 and 2 show a functional schematic view of a typical IBU.

NOTE 1: There can be in some battery systems be double protection with a fuse and circuit breaker in series, in case of very high fault current and risk of damage to the circuit breaker that prevents it to open. The fuse is then in this case a back-up protective device.

NOTE 2: The IBU communication bus is commonly a data bus e.g. CAN bus.

NOTE 3: There can in some battery systems also be LED:s or a display indicating the status of the battery, which is beneficial in situations where no remote monitoring is possible.

Figure 1 reports an example of IBU schematic diagram.

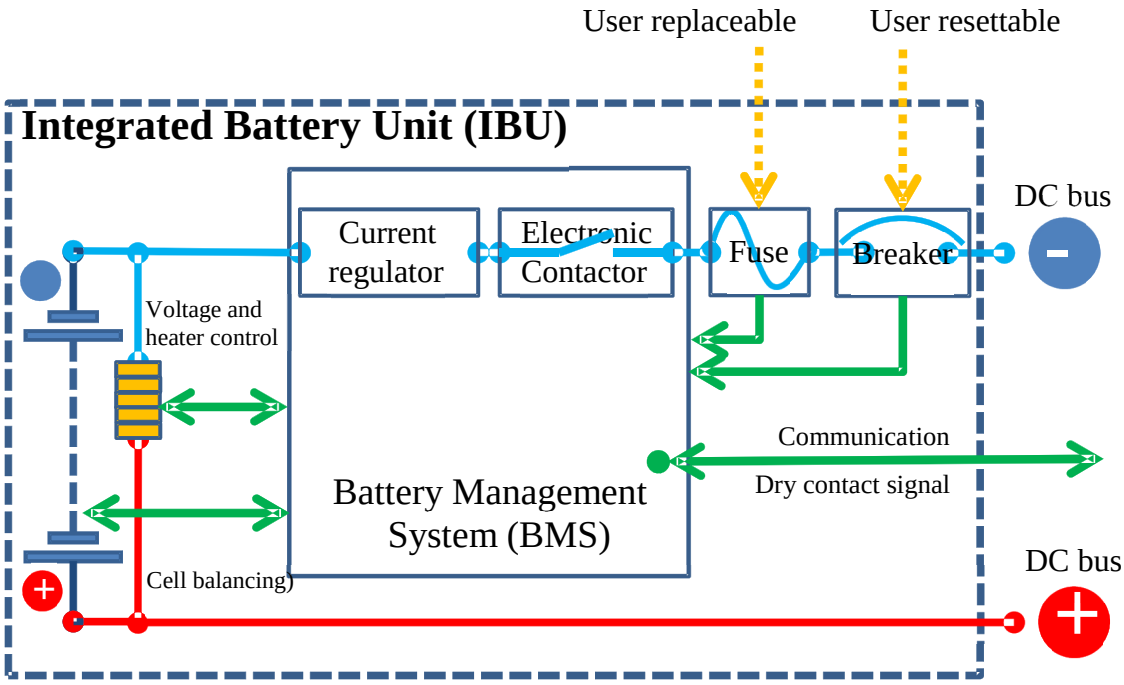


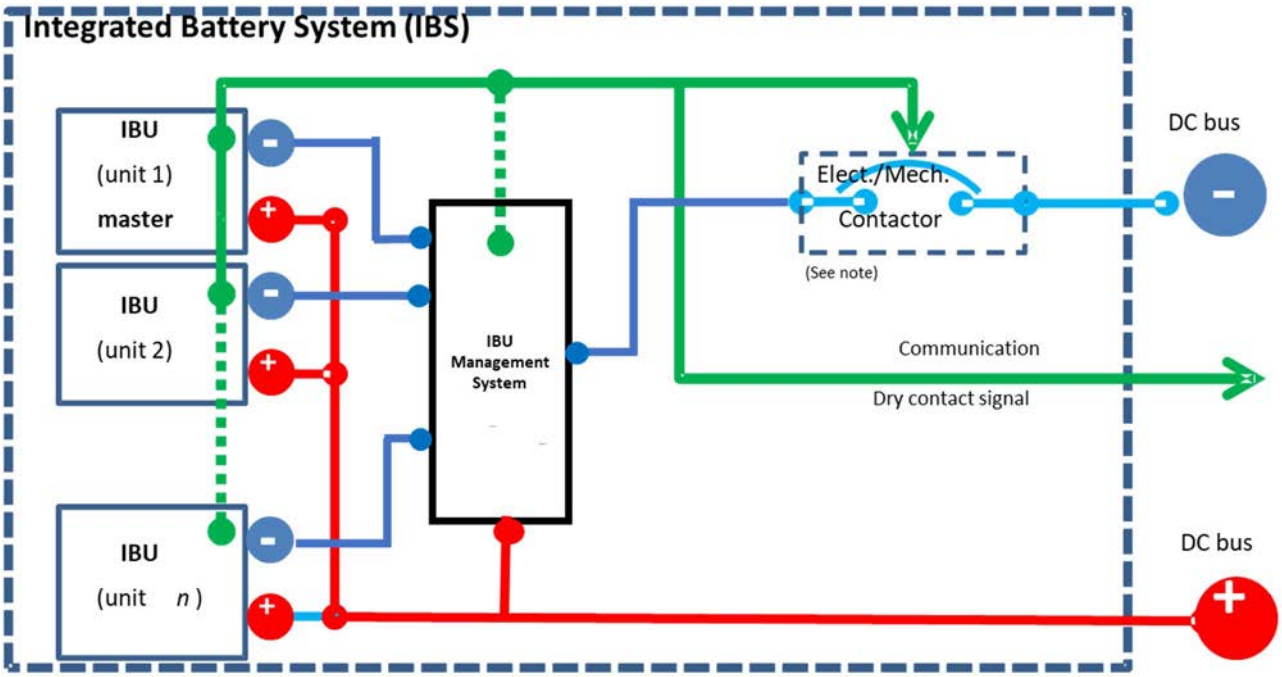
Figure 1: Functional schematic example of an IBU

4.2 Integrated Battery System (IBS)

An Integrated Battery System (IBS) can comprise several Integrated Battery Units (IBU).

In an IBS, an electronic unit may be optionally added to a system of connected IBU and this is referred to as the Master Battery Management Module (MBMM) to handle several multiple IBUs.

Figure 2 reports an example of IBS schematic diagram.



NOTE: The contactor can be optionally installed outside of the IBS, in the application side using the IBS.

Figure 2: Functional schematic of an Integrated Battery System with IBU in parallel

IBU and IBS can operate in a wide range of Telecom/ datacom ICT applications. There are three common scenarios of operation:

- a single installed IBU. In this case, the single IBU communicates with the with the power controller/controller and or NMS;
- a system of parallel connected IBU on the DC bus. In this case, each IBU communicates to a designated master IBU and the master IBU then communicates with the supervision server;
- a system of parallel connected IBUs on the DC bus combined with an optionally installed MBMM. In this case, each IBU communicates with the MBMM and the MBMM then communicates with the supervision server.

Figure 3 shows a typical functional schematic of an IBU or IBS connected in modular DC power supply system with battery backup.

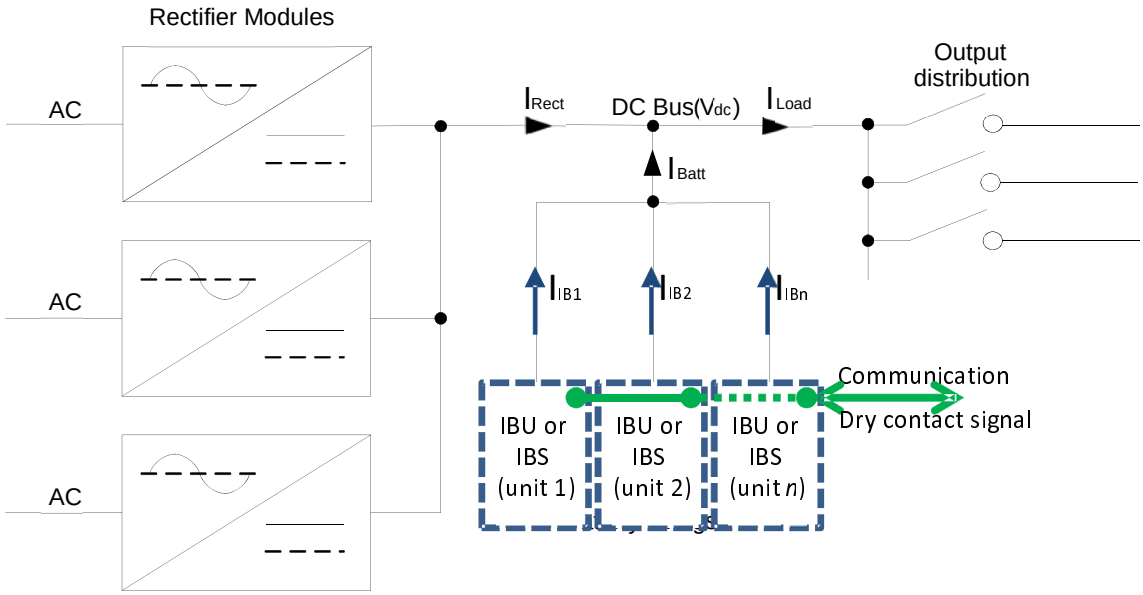


Figure 3: Functional schematic of n IBU units or IBS systems connected to a typical modular DC power supply system with battery backup

The main information that is monitored and controlled is the following:

- Installed configuration (capacity in Ah or energy in Wh, IBU output voltage, IBS output voltage)
- Charge/Discharge DC voltage and DC current
- Temperature T
- State of Charge (SoC) for each IBS
- State of Charge (SoC) for each IBU
- State of Health (SoH) for each IBS
- - State of Health (SoH) for each IBU
- Load rate (current/max current)
- Alarms (over or under voltage, temperature, charge, etc.)
- Settings (date-time, alarm thresholds, settings and program download, etc.)

Table A.1 (see annex A) corresponds to mandatory data that shall be provided for IBS control/monitoring model.

Table B.1 (see annex B) corresponds to non-mandatory data that shall be provided in addition to mandatory for IBS control/monitoring model.

Annex A (normative): Summary of mandatory monitoring/supervision information and functions

A.0 Introduction

This annex gathers the information needed on the remote monitoring application for different types of battery systems or battery unit. It specifies the mandatory requirements that shall be provided in all cases.

NOTE 1: All tables of annex A do not specify the power equipment by itself. These tables refer to subsets or devices that are not necessarily present in each equipment configuration. As a matter of fact, one alarm and its class apply only in case of the presence of this subset or device.

When an optional alarm that requires a parameter set is present, the corresponding parameter set is mandatory in the control section in order to allow remote adjustment under appropriate login procedure.

According to their types (Description, Alarm, Data, etc.), as defined in ETSI ES 202 336-1 [1] the information shall be provided by the BMS or MBMM equivalent of Control Unit (CU) described in ETSI ES 202 336-1 [1].

NOTE 2: If there is no CU this data should be provided by the Data Gathering Unit (DGU).

When a BMS or MBMM has a field data bus connected to the DGU, at least, the DGU shall store data (record measurements, log files).

NOTE 3: Partial communication network failures e.g. BMS or MBMM link fault should be detected by an upper element of the network e.g. the RMA (refer to figure 1 of ETSI ES 202 336-1 [1]).

NOTE 4: Clause 6.4 of ETSI ES 202 336-1 [1] details the parameters associated with elements e.g. time delay, severity of alarm element; general requirement on accuracy of measured parameter are contained, if not different specified in the present document in clause 8.3 of ETSI ES 202 336-1 [1]. The tables of annex A do not include the application of these parameters.

NOTE 5: In table A.1 the term BMS is used only in case of IBS.

A.1 Integrated Battery Unit (IBU) and Integrated Battery System (IBS)

Table A.1: Minimum set of monitored information

Element type	Monitored information	Explanation	Applicable to	
			IBU	IBS
alarm	Battery protective device	Fuse/Circuit Breaker open or tripped	X	
	Undervoltage and overvoltage single cell	Battery disconnected due to anomalous voltage at single cell level	X	
	Battery Low Voltage	Voltage of Battery falls below preset threshold, e.g. due to battery discharge See note.	X	
	Battery over-temperature and under temperature	Battery temperature exceeds temperature limit setting (cell or BMS)	X	
	State of Charge (SoC) low	SoC falls below preset minimum	X	
	State of Charge (SoC) total discharge	BMS activation	X	
	State of Health (SoH) abnormal	SoH falls below present minimum with pre-defined grace period	X	
	Safe mode actuated	Electronic contactor is open and the IBU or IBS has restricted operation	X	X
	Overcurrent	Output current higher than the set threshold		
	Battery over-charge (Ah in excess or high float current for lead-acid battery)	Measurement/ calculation of charge (current x time) alarm will be raised when threshold charge level is exceeded	X	
event	Alarm set and clear		X	X
	Number of charge/discharge cycles	One cycle is defined with equal or more than 80 % from initial capacity of cumulated discharge	X	X
	Change of operating mode	Change of mode, e.g. charge, discharge, float charge, sleep, safe, BMS Idle (awaiting command)	X	X
data	Terminals battery DC voltage (±0,1 V)		X	X
	Charge and discharge battery current I_{Batt}		X	X
	Battery temperature (±2 °C)		X	X
	Cumulated Wh charge		X	X
	Cumulated Wh discharge		X	X
	Cumulated Ah charge		X	X
	Cumulated Ah discharge		X	X
data record	Battery temperature (of BMS and the min and max of single or group of cells on the interval)	Battery temperature data log at 5 min interval limited to a defined number of records	X	X

Element type	Monitored information	Explanation	Applicable to	
			IBU	IBS
	Min and Max of the single-cells/cells group temperature		X	X
	State of Health (SoH)		X	X
	State of Charge (SoC)		X	X
	Remaining battery capacity	Data in Wh and Ah, establish from SoC x SoH	X	X
	Date and time		X	X
	Sliding time window to capture maximum output DC current. All BMS alarm/event/test/command parameters (time-out, counter, thresholds, etc.)	Period of time over which power data logging is carried out. E.g. one year for data with interval 5 min. On the design life for data with 1 min/max/average data per day (voltage, current, capacity in Ah and Wh).	X	X
	Charge/Discharge current and power		X	
control	BMS program download with default to previous release		X	X
	Default values resetting (safe value for BMS		X	X
	Boost mode / discharge voltage at 57 VDC			
	Battery mode setting (normal, Constant Voltage, hybrid lithium-lead, hybrid lithium-sodium, hybrid sodium-lead)			
	Associated parameters to constant voltage mode			
	Associated parameters to hybrid mode			
	Associated parameters to normal mode			
information	BMS Hardware version			
	BMS Software Version			
	Battery manufacturer details: Name and Model			
	Battery Part/Serial numbers			
	Battery Cells Manufacturing Dates			
	Battery design capacity			
	Battery usable capacity			
NOTE: Battery voltage need be taken by BMS before the DC/DC converter.				

Annex B (informative): Summary of non-mandatory monitoring/supervision information and functions

B.0 Introduction

According to their types (Description, Alarm, Data, etc.), as defined in ETSI ES 202 336-1 [1], the information should be provided by the Control Unit (CU) or by the Data Gathering Unit (DGU).

The non mandatory information of table B.1 in annex B are provided in addition to the mandatory information defined in tables of annex A.

NOTE: The "Explanation" column provided in the data tables of annex B has been used where necessary to further explain the statements in the "Monitored information" column. The "Type" column gives the assigned name used in coding and the "Monitored information" column provides details of the condition or state being monitored. The identifiers used in the "Type" column of the tables of annex B are described in ETSI ES 202 336-1 [1].

Table B.1 gives a list of useful non mandatory information for Telecom/ICT equipment power, energy and environmental parameters measurements.

B.1 Integrated Battery Unit (IBU) and Integrated Battery System (IBS)

Table B.1

Element type	Monitored information	Explanation	Applicable to	
			IBU	IBS
alarm	Unbalanced charge branch current	An unbalanced charge current of a certain percentage compared between battery strings for IBS	X	X
	Unbalanced discharge branch current			X
	Unbalanced cell voltage		X	
	Battery asymmetry (midpoint voltage)		X	
event	Battery replacement needed (based on time counters or specific conditions)			X
	Battery temperature sensor failure	This sensor is for example placed on the battery jar or close to the battery	X	X
	Antitheft activated			
data	Cumulated time spent on charge		X	X
	Cumulated time spend on discharge		X	X
	Indication of restart with back-up or customized parameters (auto-recovery in case of Control Unit reset or replacement)		X	X
	Estimated remaining battery autonomy (time) during discharge		X	X
	Battery age since date of installation		X	X
	Estimated remaining battery capacity (due to ageing) at full charge (±5 %)		X	X
	Power capacity management (ratio) = Used/Installed power		X	X
	Battery discharge time test time duration		X	X
	Antitheft state		X	X
config	Output low voltage threshold	Voltage of the output of the Battery/ output DC Bus falls below pre-set threshold, e.g. due to battery discharge See note.	X	X
	Battery over-charge threshold persistent high float current		X	X
	Battery over-temperature threshold		X	X
	Unbalanced charge string current (persistent string branch charge current difference/mean string charge current value)			X
	Unbalanced string discharge current (persistent string branch discharge current difference/mean string discharge current value)			X

Element type	Monitored information	Explanation	Applicable to	
			IBU	IBS
	Unbalanced cell voltage (persistent cell voltage difference/mean cell voltage value)		X	
	Battery test parameters			
	Output overload threshold (consumed power/ useful power where useful power is installed power without redundancy or battery recharge power)		X	X
	Battery life expectancy at 20 °C (as provided by manufacturer)		X	
control	Battery test on demand	This is related to SoH	X	X
	DC power device control	(rectifiers, Low Voltage Disconnection, etc.)	X	X
	Acknowledge battery replacement			X
	Acknowledge alarms		X	X
NOTE: Battery voltage need be taken by BMS before the DC/DC converter.				

NOTE: The parameters used to configure the battery should be in line with the manufacturers recommended settings to respect battery safety aspects.

Annex C (informative): Bibliography

- IEC 62619: "Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications".
- ETSI TR 102 336: "Environmental Engineering (EE); Power and cooling system control and monitoring guidance".
- ETSI EN 302 099: "Environmental Engineering (EE); Powering of equipment in access network".

Annex D (informative): Change history

Date	Version	Information about changes
July 2025	1.2.0	Revised table A and B to align with actual technologies.

History

Document history		
V1.1.1	September 2014	Publication
V1.2.0	July 2025	Membership Approval Procedure MV 20250919: 2025-07-21 to 2025-09-19