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General Technical Specification

BATTERY MONITORING UNIT

UMB10

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UMB10 — Introduction

The UMB10 battery monitoring unit was created with the aim of keeping storage battery problems from disrupting UPS and DC UPS systems.

If batteries are not subjected to preventive maintenance and checking, then any deficiencies will only become apparent at the most critical time, i.e., when there is a blackout.

And if a UPS system fails during a blackout, there may be considerable financial losses and physical damage.

That is why it is crucial that the batteries be checked accurately, constantly, and continuously so that the backup system can keep running correctly.

By checking the batteries precisely and repeatedly, the UMB10 unit warns you in advance of the onset of any problems in the battery bank in order to protect your important electrical systems from anomalies.

The UMB10 is available both as an independent, wall-mountable unit and in a form that can be integrated into our battery cabinets.

ADVANTAGES OF THE UMB10

- Constant checking of the battery bank
- Compatible with AGM, gel, Pb, and NiCd batteries
- Easy to install
- Draws its power from the battery bank that it checks
- 10 voltage measurement channels
- System easily configurable via web server
- Remotely controllable via web server
- Sends e-mails if anomalies are detected in batteries
- Comes with general failure relay
- Compatible with rectifiers for boost/manual charging
- Communicates using Modbus TCP/IP
- Colour backlit LCD display for:
  immediate, intuitive diagnostics using messages,
  measuring battery voltages,
  identifying the unit's operational status, and
  identifying anomalous measurement channels.

FIELDS of APPLICATION

- Oil & gas
- Electric power generation
- Transportation
- Process control
- Industry

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Tab. 1

GENERAL DATA		
Auxiliary power supply voltage	17–330V DC (Note 1)	
Current consumed by system	< 0.5A	
Number of measurement channels	10	
Measurement range for individual channels	1–100V DC	
Measurement resolution	0.1 decimal	
Battery voltage measurement precision	Max. +/- 0.2V DC	
Scanning time between channels	10 seconds	
Electrical resistance of measurement channels	> 80kΩ	
Reverse polarity protection on individual measurement channels	✓ (resettable fuse)	
Power supply protection for UMB10 unit	✓ (fuse)	
Isolation between auxiliary power supply and measurement channels	✓	
ALARMS and SIGNALS		
Battery voltage maximum	Message on LCD display	
Battery voltage minimum	Message on LCD display	
Improper charging voltage on battery	Message on LCD display	
General failure	Via dedicated relay (Note 6)	
On interface board	LED on each measurement channel (Note 7)	
On interface board	LED on general failure relay (Note 9)	
ALARM THRESHOLDS (factory settings)		
	AGM/Gel/Pb	**NiCd**
Voltage maximum alarm (floating charging mode)	2.35 V/elem.	1.45 V/elem.
Voltage maximum alarm (boost charging mode)	2.5 V/elem.	1.72 V/elem.
Voltage minimum alarm	1.75 V/elem.	1 V/elem.
	2–2.2 V/elem.	1–1.3 V/elem.
MAX. NO. OF ELEMENTS that can be set for single channel		
	AGM/Gel/Pb	**NiCd**
Floating charging mode	41 elem.	66 elem.
Boost charging mode	38 elem.	56 elem.
OTHER FUNCTIONS		
Communication via Modbus TCP/IP	✓ (Note 8)	
Integrated web server	✓ (Note 2)	
E-mail server	✓ (Notes 2–3)	
Ability to configure maximum number of measurement channels	✓ (from web server)	
Ability to configure number of battery elements per individual measurement channel	✓ (from web server)	
Ability to monitor AGM-Pb / NiCd batteries	✓ (Note 4)	
Ability to set alarm thresholds for rectifiers with boost charging	✓ (Note 4a)	
Ability to set alarm thresholds for rectifiers with manual charging	✓ (Note 5)	
FAST SCAN management for monitoring discharging batteries	✓ (Note 10)	
Ability to check system interface operating status	✓	
MECHANICAL CHARACTERISTICS		
Case	Wall-mounted, 36-module, doorless plastic switchboard External protection rating = IP20	
Operating temperature range	-10°C – +40°C	
Storage temperature range	-25°C – +70°C	
Relative humidity range	5%–95% (IEC 60068-2-30, IEC 60068-2-78)	
Approximate weight	3kg	
Approximate dimensions (W×D×H, in mm)	400×140×400	
ELECTRICAL CONNECTION CHARACTERISTICS		
Battery measurement channels / GENERAL FAILURE alarm	–Removable printed-circuit terminal Maximum applicable cable cross section = 1.5mm^2	
UBM10 power supply / Signal inputs from external rectifier	DIN guide terminal 2.5mm^2	

Note 1: To be specified when ordering.
Note 2: Permits user to configure UMB10. Permits user to remotely view and control unit's LCD display. Permits user to configure e-mail server.
Note 3: Permits user to send e-mails to 3 different groups of recipients. One e-mail is sent when an alarm situation occurs, and a second e-mail is sent when the system returns to normal.
Note 4: Dedicated terminal block for selecting battery type. (Terminal open = AGM or Pb; terminal closed toward common = NiCd.)
Note 4a : Prepared dedicated terminal block to which to attest voltage-free contact from rectifier. If active enables alarm thresholds arranged for Boost charge.
Note 5: Dedicated terminal block for certifying voltage-free contact from rectifier. When it is active, it blocks checking by UMB10, allowing the user to adjust the charging voltage freely.
Note 6: Programmed with positive logic so that when the unit is in NORMAL OPERATION (i.e., no alarms active), the RELAY is ENERGISED.
Note 7: In the event of a VOLTAGE MAXIMUM / VOLTAGE MINIMUM / NOT CHARGED CORRECTLY alarm, the system will remain stuck on the first channel that triggered the alarm. To initiate checking, press the key on the local PLC or remotely via the web server.
Note 8: All the electrical quantities and the states needed to replicate operation of the UMB10 unit on external SCADA are available.
Note 9: Electrical capacity of contact: 5A — 230V AC; 0.3A — 110V DC
Note 10 : Prepared dedicated terminal block to which to attest voltage-free contact from rectifier. If active, enables FAST SCAN mode.

HUMAN–MACHINE INTERFACE (HMI)

All information on the functional state of the system is available on the system's colour backlit LCD display. Physical keys let the user interact with the unit, and an integrated web server makes it easy to configure and use the entire system.

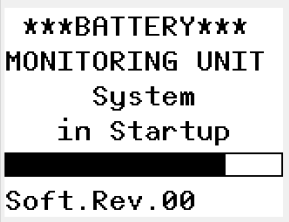

Fig. 1 UMB 10 startup screen
When power is supplied to the system, this screen will appear on the PLC display. When the horizontal bar image has turned completely black, the battery check will start.

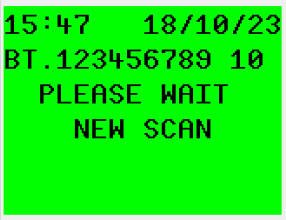

Fig. 2 Wait screen
This message is displayed every time the system selects one of the measurement channels.
The message includes the time and date.
BT.123456789 10 indicates the number of measurement channels available.

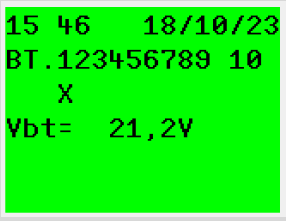

Fig. 3 Measurement screen
This message is displayed every time a measurement is made.
This message once again shows the number of measurement channels available, and the symbol "X" BT.123456789 10 X indicates which channel is currently being measured. The "X" symbol moves to show which channel the system is currently measuring.

Fig. 4 VOLTAGE MAXIMUM ALARM screen
This message is displayed if the UMB10 system, while scanning, detects a voltage higher than the reference voltages that were set, triggering this alarm on the display.
This message will alternate with the message shown in Fig. 3 to let you know which channel the alarm is for. The system will remain in this condition until the "DEL" key on the side keyboard is pressed. The alarm can also conveniently be cancelled remotely via the web server.

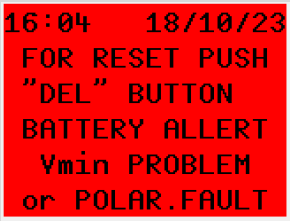

Fig. 5 VOLTAGE MINIMUM / POLARITY FAULT ALARM screen
This message is displayed if the UMB10 system, while scanning, detects a voltage lower than the reference voltages that were set, triggering this alarm on the display.
This message will alternate with the message shown in Fig. 3 to let you know which channel the alarm is for. The system will remain in this condition until the "DEL" key on the side keyboard is pressed. The alarm can also conveniently be cancelled remotely via the web server.

This alarm can also be triggered by the polarity of a battery being inverted with respect to the channel it is connected to. If that is the case, simply reconnect the battery correctly and press the "DEL" key to resume regular system operation.

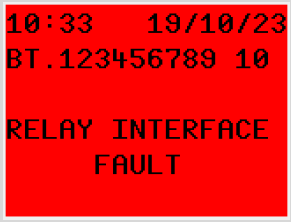

Fig. 6 RELAY INTERFACE FAULT screen
This message is displayed if the system detects an anomaly in the relay interface linked to the PLC. In this condition, the UMB10 unit goes into an electrical safety state, ceasing all operations. In addition to the message shown in Fig. 6, the system also communicates the fault status by changing the relay status to GENERAL FAILURE and by sending a specific e-mail (if the UMB10 system is connected to the internet and the relevant section of the e-mail server has been configured correctly).

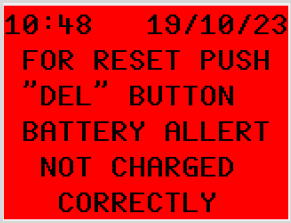

Fig. 7 NOT CHARGED CORRECTLY screen
This message is displayed if the UMB10 system detects an improper value for the charging voltage on the batteries; this situation is therefore different from the Vmax. and Vmin. situations. For more details on the thresholds that define this state, see **Improper charging alarm** in Tab. 1.

Improper charging alarm

To reset this status manually, push the “DEL” key on the side keyboard. The status can also conveniently be reset remotely via the web server.

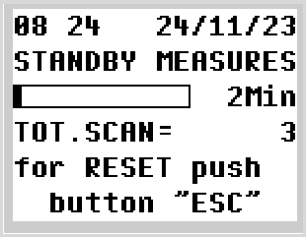

Fig. 8 STANDBY MEASURES screen
This message is displayed at the end of every complete scanning cycle. The UMB10 unit remains in this state for 60 minutes, after which it starts a new scanning cycle. To reset this status manually, push the “ESC” key on the side keyboard. The status can also conveniently be reset remotely via the web server.

When the horizontal bar image  has turned completely black, the system will restart automatically. The “xMin” field shows how many minutes have passed, prior to the system restart.

"TOT.SCAN="reports the number of scans made by the device since it has been active. The maximum count allowed is 9,999,999. Upon reaching this value, the contactor automatically resets.

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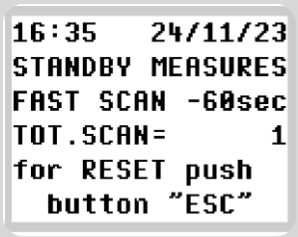


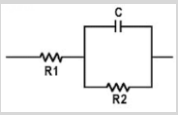
Fig.9 STANDBY MEASURES mode FAST SCAN screen.
This message appears at the end of each complete scan cycle. This mode can be activated by acting on the appropriate physical input of the UMB10 system, which is available on the terminal block in the wall-mounted version only. Activation of the FAST SCAN operating mode is useful to control the battery discharge phase during back up operation ; for this reason it is important to use a dry contact coming from the rectifier/ UPS , which enables this operating mode.
The UMB10 device remains in this state for 60 seconds (if the FAST SCAN function is not enabled the pause is 60minutes) ; when it is finished it starts again with a new scanning cycle. To manually reset this state, you must press on the "ESC" text on the side keyboard. The same operation can be conveniently done remotely using the WEBSERVER.

"TOT.SCAN="reports the nr.of scans the device has made since it is active. The maximum allowed count is 9,999,999 reached this value the contactor automatically resets itself

OPERATING PRINCIPLE

The UMB10 unit uses the basic principle of electronics, Ohm's law: V = I*R.
A group of batteries connected in series is similar to a series of electrical resistors.

Fig. 2a shows a schematic diagram of the internal electrical structure of a battery. Fig. 2a



Assuming that the current flowing through the resistors is constant and that the resistors are all of equal resistance, the voltage drop measured across each resistor will be equal. This principle also applies in the case of a battery bank. Initially, the internal resistance of the individual batteries will be essentially identical, but over time the internal resistance will tend to increase. The resistance increases due to factors such as the quality of the materials used in the batteries, the operating temperature, and the charge-discharge cycles that the battery bank is put through. What needs to be emphasized is that the change in internal resistance is not uniform, i.e., it varies from battery to battery. Returning to the basic principle given above, when a battery bank is being charged with a constant, electronically limited current, it is clear that if the internal resistance on the individual batteries is different, then the voltage measured between the ends of the batteries will also be different from one battery to another. These voltages are what the UMB10 measures. This concept can be grasped better by looking at Fig. 1a and Fig. 1b. These two figures show a PC simulation of different internal resistances in a group of batteries, and how the different internal resistances affect the voltage of the individual batteries.

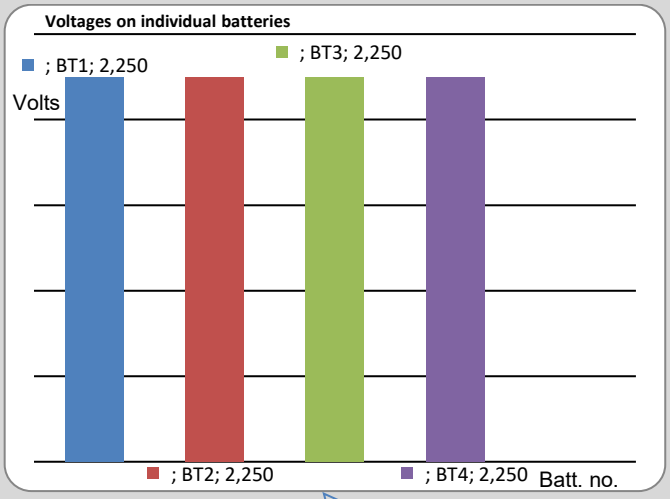


Fig.: 1a

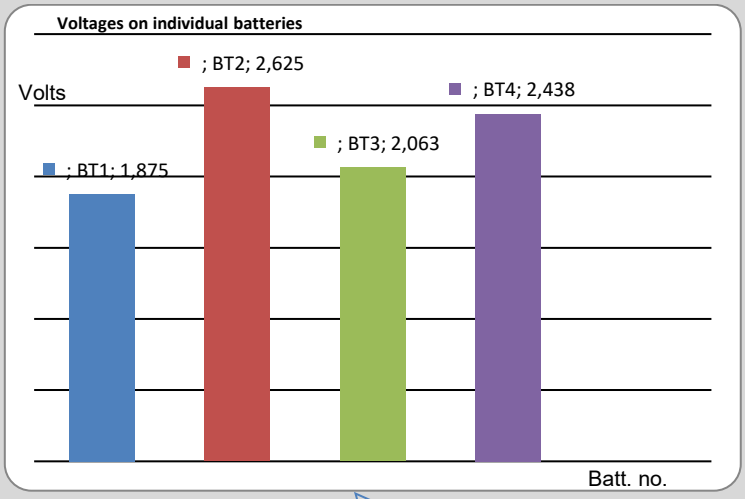


Fig. 1b

Data:

Number of batteries = 04
Nominal battery voltage = 2V DC
Capacity = 400Ah
Internal resistance (from data sheet) = 0.5mΩ
Charging current = 40A
Floating charging voltage = 9V DC
Floating voltage per battery = 2.25V DC

The voltage measured at the ends of the batteries is correct for all batteries, and the same value is measured on all the batteries.

Data:

Number of batteries = 04
Nominal battery voltage = 2V DC
Capacity = 400Ah
Internal resistance BT1 = 0.5mΩ BT2 = 0.7mΩ
BT3 = 0.55mΩ BT4 = 0.65mΩ
Charging current = 40A
Floating charging voltage = 9V DC
Floating voltage per battery = 2.25V DC

The voltage measured at the ends of the batteries is NOT correct for all batteries, since the value for each battery is different due to different internal resistances.

Brief description of the figures

The simulation represents 4 new batteries connected in series (Fig. 1a). Later, differences in internal resistance arise in BT2, BT3 and BT4, and the results of the changes are shown in Fig. 1b. As can be seen, the voltages at the ends of the individual batteries change due to changes in the batteries' internal resistance.

Data Transmission — Modbus® Protocol

RJ45 PORT

The UMB10 unit supports TCP/IP communication using the Modbus® protocol configured for SLAVE; the network parameters can be configured by the user via the web server. To collect the data that the system makes available, the Client needs to be using a supervision software package that supports use of the Modbus® protocol configured for MASTER (max. 2 devices simultaneously). It is the supervision software that takes care of requesting data from our system.
Settings to be used to establish connection to the UMB10:

Modbus® function code to use = 04 — INPUT REGISTER
Communication port = 502
ID = 1

Modbus® address table

Address	Type	Description	Scaling	Notes
30001	Word	SETPOINT CHANNEL NO.	Not necessary	Permitted value: 1–10
30002	Word	CH1: BATT. ELEM. NO.	Not necessary	(Note 1b)
30003	Word	CH2: BATT. ELEM. NO.	Not necessary	(Note 1b)
30004	Word	CH3: BATT. ELEM. NO.	Not necessary	(Note 1b)
30005	Word	CH4: BATT. ELEM. NO.	Not necessary	(Note 1b)
30006	Word	CH5: BATT. ELEM. NO.	Not necessary	(Note 1b)
30007	Word	CH6: BATT. ELEM. NO.	Not necessary	(Note 1b)
30008	Word	CH7: BATT. ELEM. NO.	Not necessary	(Note 1b)
30009	Word	CH8: BATT. ELEM. NO.	Not necessary	(Note 1b)
30010	Word	CH9: BATT. ELEM. NO.	Not necessary	(Note 1b)
30011	Word	CH10: BATT. ELEM. NO.	Not necessary	(Note 1b)
30012	Word	STATUSES and ALARMS	Not necessary	See Tab. 2
30013	Word	MEASUREMENT PULSE COUNT VALUE	Not necessary	
30014	Word	BATTERY VOLTAGE MEASUREMENT VALUE	Word/10	Meas. resolution: 0.1V DC
30015	Word	STATUSES and ALARMS	Not necessary	See Tab. 2

Note 1b: For details, see Tab. 1, “MAX. NO. OF ELEMENTS that can be set for single channel.”

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Tab. 2

Word	Bit	Description	Bit state*	Notes
30012	1	GENERAL SYSTEM FAILURE	1	
	2	BATTERY Vmax. ALARM	0	
	3	BATTERY Vmin. ALARM	0	
	4	BATTERY NOT CHARGED CORRECTLY ALARM	0	
	5	STATUS CH1 ON	-	(Note 2b)
	6	STATUS CH2 ON	-	(Note 2b)
	7	STATUS CH3 ON	-	(Note 2b)
	8	STATUS CH4 ON	-	(Note 2b)
	9	STATUS CH5 ON	-	(Note 2b)
	10	STATUS CH6 ON	-	(Note 2b)
	11	STATUS CH7 ON	-	(Note 2b)
	12	STATUS CH8 ON	-	(Note 2b)
	13	STATUS CH9 ON	-	(Note 2b)
	14	STATUS CH10 ON	-	(Note 2b)
	15	RELAY INTERFACE BOARD FAULT	0	
	16	UMB10 OPERATIONAL STATUS	-	(Note 3b)
30015	1	BIT CLOCK COUNT	0/1	
	2	UMB10 PAUSED (Fig. 8)	0	
	3	UNUSED	0	
	4	EXT. BATT. CHAR. IN BOOST CHARGING	0	See Note 5, Tab. 1
	5	EXT. BATT. CHAR. IN MANUAL CHARGING	0	See Note 5, Tab. 1
	6	BATTERY TYPE SELECTION STATUS		0=AGM/GEL/Pb 1=NiCd
	7	UNUSED		
	8	UNUSED		
	9	UNUSED		
	10	UNUSED		
	11	UNUSED		
	12	UNUSED		
	13	UNUSED		
	14	UNUSED		
	15	UNUSED		
	16	UNUSED		

Note 2b: The bit changes to logical 1 when the UMB10 system selects that particular measurement channel, but otherwise it is logical 0.
The bit also changes to logical 1 if a fault (Vmax./Vmin./improper charging) is detected in combination with bits 30012[2], 30012[3] or 30012[4].

Note 3b: Bit logical state 1 = UMB10 powered and operational / Bit logical state 0 = UMB10 not powered / malfunctioning

* = Bit state when system is functioning regularly

Note: Other types of protocols are available on request.

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Testing

The system will be subjected to in-house testing and calibration, for which certificates will be issued.

At a minimum, the following tests will be performed:

- Visual examination
- Function check
- Isolation test
- Instrument calibration check

In addition, in-house acceptance tests are performed on components and/or materials from outside that are used in the order.

Documentation

The entire order will be subjected to quality checks and procedures, such as ISO9001.

The order includes all documents necessary and/or required for start-up and use, such as:

- Test certificates
- Certificates of conformity
- Wiring diagrams
- Mechanical layouts
- Instruction manual
- Commissioning procedures

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Reference standards

EMC standard:	EN IEC 61000-6-2 EN IEC 61000-6-4	Other:
Immunity:	EN IEC 61000-4-2	IEC 60068-2-30 IEC 60068-2-6
Low voltage switchgear:	CEI EN 61439-1-2 CEI EN 60947-2	
Cables:	CEI 20-22 (IEC 60332-3 where applicable) CEI 20-38 CEI 20-45	
Cables — colors:	CEI EN 60204-1	
Cables — alphan. identif.:	CEI EN 60445:2018-03	
Colors, alphan. identif.:	CEI EN 60445:2018-03	
Protection rating:	IEC 60529	
Mechanical:	CEI EN 61439-1	
Protection devices:	IEC 60127-1	
Safety:	IEC EN 50178	
PLC:	IEC EN 61131-2	