

Battery Monitoring System

Type M3749

OPERATING MANUAL



Warranty:

Mostec warrants this product to be free of manufacturing defects for a 2-year period after the original date of purchase. Within this period, defective products will be repaired free of charge provided that the defect occurred during normal operation. This warranty does not cover damage to the product resulting from ordinary usage such as front panel scratches, broken control elements and corrosion, etc. The customer is responsible for shipping and packing charges for products returned under warranty to Mostec. Mostec warrants this product beyond the 2-year warranty period for an additional 2 years in case of long term damages due to improper manufacturing. Such damages as poorly soldered joints or other assembly problems are also covered by the warranty. Transportation damages are not covered by the warranty and should be referred to the respective delivery service.

Technical data

The battery monitoring system is used to permanently monitor fixed installed USV batteries. The instrument monitors the attached battery while it records constantly the battery's parameters to the plugged USB-stick. When needed, the stick can be removed any time to evaluate the current and past battery state.

All cell voltages as well as the current, the ripple current and the ripple voltage of the whole battery are available on the USB-stick if wanted. Furthermore also the battery room temperature and its hydrogen concentration are also written to the USB-stick.

On the high resolution display all measured parameters can directly be displayed without the use of a PC or a tablet.

Since the instrument is equipped with a standard MODBUS RTU interface, the data can easily be made available on your local PLC or PC without a large software overhead. Like this, the battery is remotely monitored and you have the data available at all times.

In case, you need to monitor more than 60 cells, the instrument is cascadable with its second RS485 interface in order to monitor up to 540 cells.

Furthermore, the instrument has 3 potential free relay contacts. Multiple parameters can be programmed to these relays to have a simple interface. Like this the instrument is connected to a PLC without the use of MODBUS.

For discharge and impedance tests, the instrument can be directly connected via USB to the Megger Torkel instrument.

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1. Safety Instructions

Observe the local regulations and safety regulations for electrical, low-voltage and high-voltage systems.



Please read this document carefully before using this product.



The device must be protected against inadmissible humidity, vibrations and severe soiling.



During an installation, all off the cables that are connected to the device must be free of electrical power.



The limit values for the measured quantities specified in the specification must not be exceeded under any circumstances.



The wiring, commissioning and operation of the devices must be carried out by appropriately qualified personnel in accordance with local regulations.



If it is to be assumed that the device can no longer be operated safely, it must be put out of operation and secured by means of identification before further commissioning.



Failure to observe the safety instructions may result in damage to the device and injury to the operator.



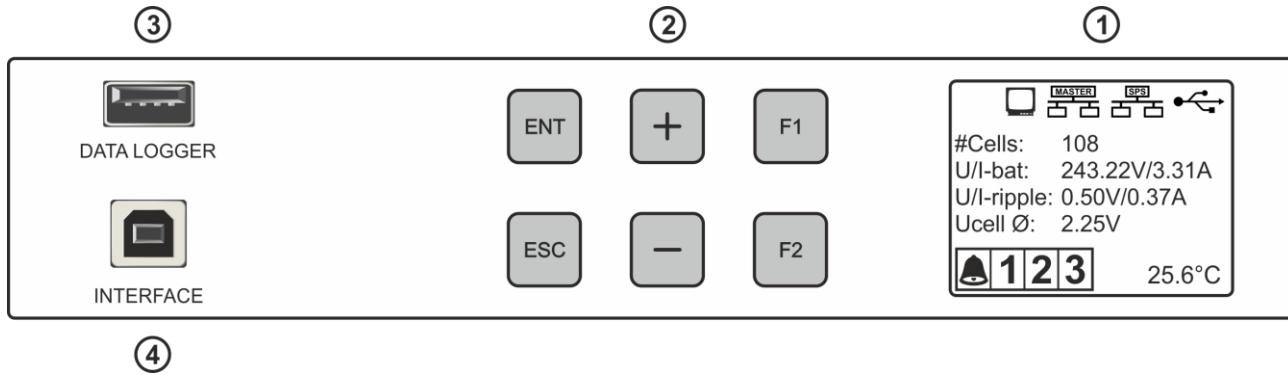
Each line which is led by the battery, may be connected only by means of upstream fuse.



2. Operating Regulations

1. Connect the device according to the wiring diagram.
2. After everything has been correctly connected, turn on the system power.
3. Press **[ENT]** and **[ESC]** simultaneously for about 1 second to open the user menu and make all required settings.

3. Front Panel

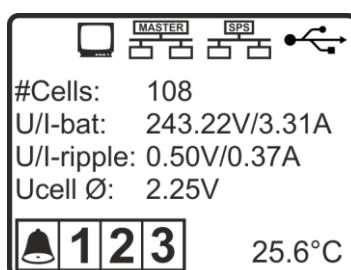


1. TFT display
2. Keyboard with key [ENT], [ESC], [+], [-], [F1], [F2]
3. USB socket type A for USB flash drive
4. USB socket type B for computer connection

4. Display Screens

After the startup process, the display switches to the main screen.

4.1. Main Screen



The main screen displays the most important information such as the number of connected cells, battery voltage and current, ripple voltage and current as well as the average cell voltage. Furthermore the status of the limit values and the temperature of the external temperature sensor are displayed.

The symbols on the top shows the status of the peripherals:

	If a USB stick is connected the USB symbol appears in black color. The color switches to red if the stick is busy. Do not remove the stick while it is busy. For a safe remove go to the USB setting and stop the logging function.
	Shows the RS485 interface activity.
	If the device is configured as a Master or as a Slave device the M3749 cascade symbol appears with the specific configuration. The communication activity is shown in the lower small boxes. The right box corresponds the Master request and the left box shows the Slave response activity.
	If the Megger Torkel is connected the symbol appears. The symbol flashes in green color if a communication is in progress.
	The wireless symbols appears if a mobile phone is connected through Bluetooth.

From the main screen you may enter the following screens:

- Press **[ENT]** and **[ESC]** simultaneously for about 1 second to enter the user menu.
- Press **[F1]** to enter the grid view of cell measurement such as U/Urp/Z.
- Press **[F2]** to enter the alarm log.
- Press **[F1]** and **[F2]** simultaneously for about 1 second to switch from U/I-ripple to Z/Z Ø.

4.2. Alarm Log Screen

Alarm log		14:45 22.08.18
		Relay Ucell Ibat Temp AuxIn Urip Irip Zcell Ubat
A1	14:45 22.08.18	1 0 0 0 0 0 0 0 0 ↓
A2	14:45 22.08.18	0 0 0 0 0 0 0 0 0
A3	14:45 22.08.18	0 0 0 0 0 0 0 0 0
A1	01:20 20.08.18	1 0 0 0 0 0 0 0 0 ↓
A2	16:45 18.08.18	0 0 0 0 0 0 0 0 0
A2	12:12 18.08.18	1 0 0 † 0 0 0 0 0
A1	06:20 10.08.18	0 0 0 0 0 0 0 0 0
A1	06:10 10.08.18	1 0 † 0 0 0 0 0 0
A1	06:05 10.08.18	0 0 † 0 0 0 0 0 0

The alarm log screen displays the latest 20 alarm events as well as the current alarm status in the first 3 lines. Press **[+]** or **[‐]** the scroll through the log list. After a device reset the log list will be empty. On the top right screen you find the actual time and date.

Press **[ESC]** to exit this screen.

4.3. Grid Screen

U-Cell [V] #1-30				
2.49	2.50	2.49	2.49	2.48
2.49	2.49	2.52	2.49	2.51
2.49	2.50	2.49	2.59	2.48
2.49	2.49	2.50	2.49	2.52
2.45	2.49	2.49	2.44	2.49
2.49	2.51	2.46	2.44	2.49

The grid screen displays the cell voltage, ripple voltage and impedance of each cell. Press **[F1]** to get to the next grid page. After toggling through each page you will get back to the main screen.

If a cell is not connected or it's a intercell connection the screen shows a '‐' sign at the corresponding place.

Press **[ESC]** to exit this screen.

5. User Menu

Settings

Measure Settings
 Device Settings
 Relay Settings
 USB Settings
 Modbus Settings
 Device Info

The user menu is divided into different submenus. In these, device-specific manipulations can be made.
 To enter the menu, press **[ENT]** and **[ESC]** simultaneously for about 1 second.

Menu item	Submenu items	Section
Measure Settings Messeinstellungen	Reset statistics Adjust current clamp range	5.2. Measure settings
Device Settings Geräteeinstellungen	Select language Activate locking code Adjust backlight Set Master/Slave settings	5.3. Device settings
Relay Settings Grenzwerteinstellungen	Relay 1 - 3: Enable and adjust limits of:	5.4. Relay settings
USB Settings USB Einstellungen	Set log interval Setting the time Setting the date Stop logging	5.5. USB settings
Modbus Settings Modbus Einstellungen	Set Modbus address Set Modbus baudrate	5.6. Modbus settings
Device Info Geräteinfo	Firmware version Serial number	5.7. Device info

5.1. Operating the user menu

The menu is operated with the keys **[ENT]**, **[ESC]**, **[+]** and **[-]**. Use **[+]** and **[-]** to navigate through the menu items. Press **[ENT]** to enter the respective submenu and press **[ESC]** to exit the submenu. In the submenu you can navigate through the individual points with **[+]** and **[-]**. Press **[ENT]** to activate the parameters which can be changed with **[+]** and **[-]**. Pressing **[ENT]** saves the value, **[ESC]** discards the changes.

5.2. Measure Settings

Measure Settings

Reset statistics

Current clamp range 200A

The menu is operated with the keys **[ENT]**, **[ESC]**, **[+]** and **[-]**.
 Settings can be made as described in section **5.1. Operating the user menu.**

Menu item	Description	Possible values
Reset statistics Statistik zurücksetzen	Resets the statistic index (min, max, avg) of the measurement parameter I-bat, I-ripple, AuxInput and Temperature which are mainly used by Modbus.	Press [ENT] to reset the statistics.
Current clamp range Stromzange	Adjustment of connected current clamp range.	Adjustable from 0 to 3000 A.

5.3. Device Settings

Device Settings

Language

ENG

Code

0

Backlight

50%

Master/Slave

The menu is operated with the keys **[ENT]**, **[ESC]**, **[+]** and **[-]**.
 Settings can be made as described in section **5.1. Operating the user menu.**

Menu item	Description	Possible values
Language Sprache	Set the user language.	<ul style="list-style-type: none"> - GER (Deutsch) - ENG (English) - FRA (Français)
Code Sperrcode	Set a lock code for the menu to prevent manipulation of the settings. It is still possible to view all menu items.	<ul style="list-style-type: none"> - 4-digit from 0001 bis 9999 - 0000 => no code (=factory) <p>Note: Please contact us if you miss the code</p>
Backlight Helligkeit	Set the display brightness.	Adjustable from 5% to 100%. Attention: 100% brightness leads to faster LED wear!
Master/Slave Master/Slave	Settings for M3749 cascading.	Press [ENT] to enter submenu. Refer section 6.

5.4. Relay Settings

Relay Settings

Relay 1
Relay 2
Relay 3

The three potential-free changeover can be configured in the **relay settings** submenu.

Use the **[+]** and **[−]** keys to navigate through the limit values. Press **[ENT]** to access the submenu of the respective limit value and press **[ESC]** to exit the submenu.

5.4.1. Relay 1 - 3

The menu is operated with the keys **[ENT]**, **[ESC]**, **[+]** and **[−]**. Settings can be made as described in section **5.1. Operating the user menu**. Each relay can be configured with the following parameter. Multiple parameter are assignable for one relay. Each parameter has an upper and lower limit refer following table.

Relay X

U-cell
I-battery
Temperatur
AuxInput
U-ripple
<1/3>

Relay X

I-ripple
Z-cell
U-battery
Turn on delay 0s
Relay norm.
<2/3>

Relay X

Status indicator norm.
<3/3>

U-cell

Enable	Off
Lower limit	0.80V
Upper limit	1.90V
Hysteresis	0.02V

Parameter submenu:

Each parameter may be enabled or disabled for the corresponding relay. If the parameter has an upper and lower limit both can be selected with **[ENT]** key. If the parameter has only an upper limit the lower one aren't selectable. Hysteresis used for both limit if applicable.

Menu item	Description	Possible values
U-cell U-zelle	Parameter submenu, cell voltage Lower and upper limit	Adjustable between 0.00 and 655.35 V.
I-battery I-batterie	Parameter submenu, battery charge-discharge current Lower and upper limit	Adjustable between -3276.8 and 3276.7 A.
Temperature Temperatur	Parameter submenu, temperature sensor Lower and upper limit	Adjustable between -30.0 and 70.0 °C.
AuxInput AuxInput	Parameter submenu, auxiliary input 4...20mA Lower and upper limit	Adjustable between 0.00 and 30.00 mA.
U-ripple U-rippel	Parameter submenu, cell ripple voltage Upper limit	Adjustable between 0.00 and 655.35 V.
I-ripple I-rippel	Parameter submenu, battery ripple current Upper limit	Adjustable between 0.0 and 6553.5 A.

Menu item	Description	Possible values
Z-cell Z-zelle	Parameter submenu, cell impedance Upper limit	Adjustable between 0.0 and 6553.5 mOhm.
U-battery U-batterie	Parameter submenu, battery total voltage Lower and upper limit	Adjustable between 0.0 and 6553.5 V.
Turn on delay Einschaltverzögerung	Relay turn on delay if limits are exceeded.	Adjustable between 0 and 3600 s.
Relay Relais	Set the logic of the relay. NO/NC	<ul style="list-style-type: none"> - Norm. = NO = Relay activated if upper or lower limit exceeds - Inv. = NC = Relay activated if value is within limits
Status indicator Statusanzeige	Set the logic of the displayed status indicator	<ul style="list-style-type: none"> - Norm. = Normal = Status active if relay activated - Inv. = Inverted = Status deactivated if relay activated

5.5. USB Settings

USB Settings	
Log Interval	5s
Time	14:56
Date	26.08.18
Logging	stop

The menu is operated with the keys **[ENT]**, **[ESC]**, **[+]** and **[-]**.
Settings can be made as described in section **5.1. Operating the user menu**.

Further information about the USB Data Logger refer section 6.

Menu item	Description	Possible values
Log Interval Log Intervall	Set the storage interval of the USB logger	Adjustable from 5s to 7200s (2h)
Time Zeit	Set the current time for the USB logger (time is stored for 3 hours in case of power failure)	<ul style="list-style-type: none"> - Hours: 0...23 - Minutes: 0...59 - Seconds are set to 0 when setting the minutes
Date Datum	Set the current date for the USB logger (date is saved for 3 hours in case of power failure)	<ul style="list-style-type: none"> - Day: 1...31 - Month: 1...12 - Year: 0...99
Logging Log	Terminates the log and saves the log file on the USB storage medium with time and date / Starts the logging.	Press [ENT] to confirm Note: Log starts automatically if a USB drive is reconnected.

5.6. Modbus Settings

Modbus	
Modbus address	1
Modbus baudrate	38400
Modbus mode	8-N-1

The menu is operated with the keys **[ENT]**, **[ESC]**, **[+]** and **[-]**. Settings can be made as described in section 5.1. **Operating the user menu**.

Further information about the Modbus refer section 8.

Changes valid after reboot.

Menu item	Description	Possible values														
Modbus address Modbus Adresse	Set the Modbus address for RS485 interface (Terminal 77-84).	Adjustable from 1 to 247														
Modbus baudrate Modbus Baudrate	Adjust the RS485 baudrate. Adjustable from 2 to 7. <table border="1" data-bbox="538 774 1473 871"> <tr> <td>Code</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> </tr> <tr> <td>Baudrate</td> <td>4800</td> <td>9600</td> <td>19'200</td> <td>38'400</td> <td>57'600</td> <td>115'200</td> </tr> </table>	Code	2	3	4	5	6	7	Baudrate	4800	9600	19'200	38'400	57'600	115'200	
Code	2	3	4	5	6	7										
Baudrate	4800	9600	19'200	38'400	57'600	115'200										
	Note: Code only for firmware < V1.1.0															
Modbus mode Modbus Modus	Set the Modbus address for RS485 interface Data bits: 8 Parity: N=None, E=Even, O=Odd Stop bit: 1 oder 2	8-N-1, 8-N-2, 8-E-1, 8-E-1, 8-O-1, 8-O-1														

5.7. Device info

Device Info	
Firmware Version	1.1.0
Serial Number	115

The submenu **device info** shows the current firmware version and the serial number of the device.

6. Cascading

If the measuring system has to measure more than 60 cells the system can easily expand by cascading another M3749. Up to 8 Slave can connected to 1 Master. The connection between Master and Slave will made with the 'M3749 Cascading' terminal. For wiring details refer section 9.

Configuration example: 1 Master and 1 Slave

Following setup are made in the sub menu of device settings in the user menu refer section 5.3.

Single Mode	
Master/Slave	The device is used in single mode. Master/Slave mode is deactivated.
Master/Slave Mode	
Master/Slave	The device is used in Slave mode . The same Slave address has to be configured on the Master device. If more than one Slave is used in a measuring system, each Slave must have a different address. Note: The Slave uses I-bat and I-rpl from the Master device. The Slave current clamp will be ignored. If no Master device is connected the current is zero.
Master/Slave	The device is used in Master mode . One Slave is connected in this example. The Slave becomes the address 2. All other Slave addresses are set to 0 which means a deactivation of Slave No.2-8. Note: The Master is able to communicate with 8 different Slave. The Slave index used by the Modbus documents corresponds to the 'Slave address' menu item in a descending order.
Enable	Off
Mode	Slave
Slave address	2
Slave address	0
Slave address	0
<1/2>	

7. USB Data Logger

7.1. USB Characteristics

- The device only accepts USB sticks which are FAT32 formatted and empty.
- The time and date must be set before plug-in the USB flash drive.
These settings remain in the de-energized state for a period of < 3h. After this period, the date and time must be readjusted.
- In the menu item **log Interval** you can set the interval time in which the data are recorded.
- As soon as a valid storage medium is detected by the device, the USB symbol appears on the display and the logging process starts.
- Do not remove the storage medium while it is busy (displayed in red on main screen).
- For a safe remove go to the USB setting and stop the logging function.
- The device creates everyday a new log file and archives the old one.
- Backup the generated data and clean up the drive once in a while (e.g. each year).

7.2. Log File Format

The data is saved in CSV format under the following name key: "JJMMDDXX.csv"

JJ = last 2 digit of current year (e.g. 2018 = „18“)
 MM = current month
 DD = current day
 XX = file counter (0-99)

The CSV format can be interpreted with common spreadsheet programs. The used separator is ';' and the encoding is Unicode (0x00-0xFF).

7.3. Log Data - Header Part

The log files includes the header part with all information about the device (e.g. Type, Serial No, Firmware/Hardware Version and Alarm Settings of each relay).

Header example:

Type:	M3749			
Ser.#:	119			
FW/HW Version:	1.00.09/01.00.00			
Alarm Setting	Parameter	K1	K2	K3
	Ucell_min/Ucell_max	0.80/1.90 V	0.80/1.90 V	0.80/1.90 V
	I discharge_min/I charge_max	-10.0/10.0 A	-10.0/10.0 A	-10.0/10.0 A
	Temp_min/Temp_max	-30.0/70.0 °C	-30.0/70.0 °C	-30.0/70.0 °C
	AuxIn_min/AuxIn_max	4.00/20.00 mA	4.00/20.00 mA	4.00/20.00 mA
	Threshold Z [mOhm]/Uripple [V]/Iripple [A]	10.00/0.50/10.00	10.00/0.50/10.00	10.00/0.50/10.00
	Ubat_min/Ubat_max	108.0/141.0 V	108.0/141.0 V	108.0/141.0 V
	Turn on delay	0000 s	0000 s	0000 s

7.4. Log Data - Measuring Part

After the header part all measuring values and status were printed as described below. Beginning from the left.

Column	Description																							
Device#	Device numbering, e.g. 0. Shows where the data belongs to. In Master/Slave mode, the Master device (#0) logs also the values of the slave devices (#1-8) and increment the device number with each slave.																							
Date	Shows the date and time of the measuring values. Format is DD.MM.YYYY, HH:MM:SS																							
Time																								
Alarm K1	Shows which alarm parameter is active on the corresponding alarm relay. Hexadecimal displayed bit-coded byte. Combination possible.																							
Alarm K2	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>0x01</td><td>0x02</td><td>0x04</td><td>0x08</td><td>0x10</td><td>0x20</td><td>0x40</td><td>0x80</td></tr> <tr> <td>Ucell</td><td>Ibat</td><td>Temp.</td><td>AuxIn</td><td>Urpl</td><td>Irpl</td><td>Zcell</td><td>Ubat</td></tr> </table>								0x01	0x02	0x04	0x08	0x10	0x20	0x40	0x80	Ucell	Ibat	Temp.	AuxIn	Urpl	Irpl	Zcell	Ubat
0x01	0x02	0x04	0x08	0x10	0x20	0x40	0x80																	
Ucell	Ibat	Temp.	AuxIn	Urpl	Irpl	Zcell	Ubat																	
Alarm K3																								
Relais Status	Shows if relay K1, K2 and K3 is activated. Hexadecimal displayed bit-coded byte. Combination possible.																							
Temperatur [°C]	Value of external PT100 temperature probe.																							
Current [A]	Charge or discharge current measured by the current clamp.																							
Ripple Current [A]	Ripple current measured by the current clamp.																							
Aux Input[mA]	Input current of the auxiliary input terminal.																							
U Total [V]	Sum of all connected cell voltages. In Master/Slave mode, the Master device (#0) shows the total voltage of all cells in the system. The Slave devices (#1-8) only the sum of cells from itself.																							
Z Total [mOhm]	Battery impedance. In Master/Slave mode, the Master device shows the total impedance of all cells in the system. The Slave device only the sum of cells from itself.																							
U #01 ... U#60	Cell voltage of cell 1 – 60 [V]																							
Uripple #01 ...#60	Cell ripple voltage of cell 1 – 60 [V]																							
Z c01 ... c60	Cell impedance of cell 1 – 60 [mOhm]																							

Measuring values example:

Device#	Date	Time	Alarm K1	Alarm K2	Alarm K3	Relais Status	Temperatur[°C]	Current[A]	Ripple Current [A]	Aux Input[mA]	U Total [V]
0	26.09.2018	17:11:03	0x00	0x00	0x00		27.196	14.692	9.117	0.017	149.591
0	26.09.2018	17:11:08	0x00	0x00	0x00		27.191	14.692	9.117	0.017	149.591
0	26.09.2018	17:11:13	0x00	0x00	0x00		27.159	14.735	9.13	0.017	149.674
0	26.09.2018	17:11:18	0x00	0x00	0x00		27.154	14.743	9.13	0.017	149.692
0	26.09.2018	17:11:23	0x00	0x00	0x00		27.159	14.743	9.13	0.017	149.705
0	26.09.2018	17:11:28	0x00	0x00	0x00		27.159	14.743	9.13	0.017	149.705
0	26.09.2018	17:11:33	0x00	0x00	0x00		27.165	14.745	9.139	0.017	149.715

U Total [V]	Z Total [mOhm]	U #01	U #02	U #59	U #60	Uripple #01	Uripple #02	Uripple #59	Uripple #60	Z c01	Z c02	Z c59	Z c60
149.591		0	2.477	2.483	2.498	2.505	0.001	0.001	0.002	0.002	0.124	0.124	0.124
149.591		0	2.477	2.483	2.498	2.505	0.001	0.001	0.002	0.002	0.124	0.124	0.124
149.674		0	2.486	2.492	2.496	2.503	0.001	0.001	0.002	0.002	0.124	0.124	0.124
149.692		0	2.488	2.492	2.498	2.503	0.001	0.001	0.002	0.002	0.124	0.124	0.124
149.705		0	2.488	2.492	2.496	2.504	0.001	0.001	0.002	0.002	0.124	0.124	0.124
149.705		0	2.488	2.492	2.496	2.504	0.001	0.001	0.002	0.002	0.124	0.124	0.124
149.715		0	2.488	2.492	2.498	2.503	0.001	0.001	0.002	0.002	0.124	0.124	0.124

8. Modbus-RS485

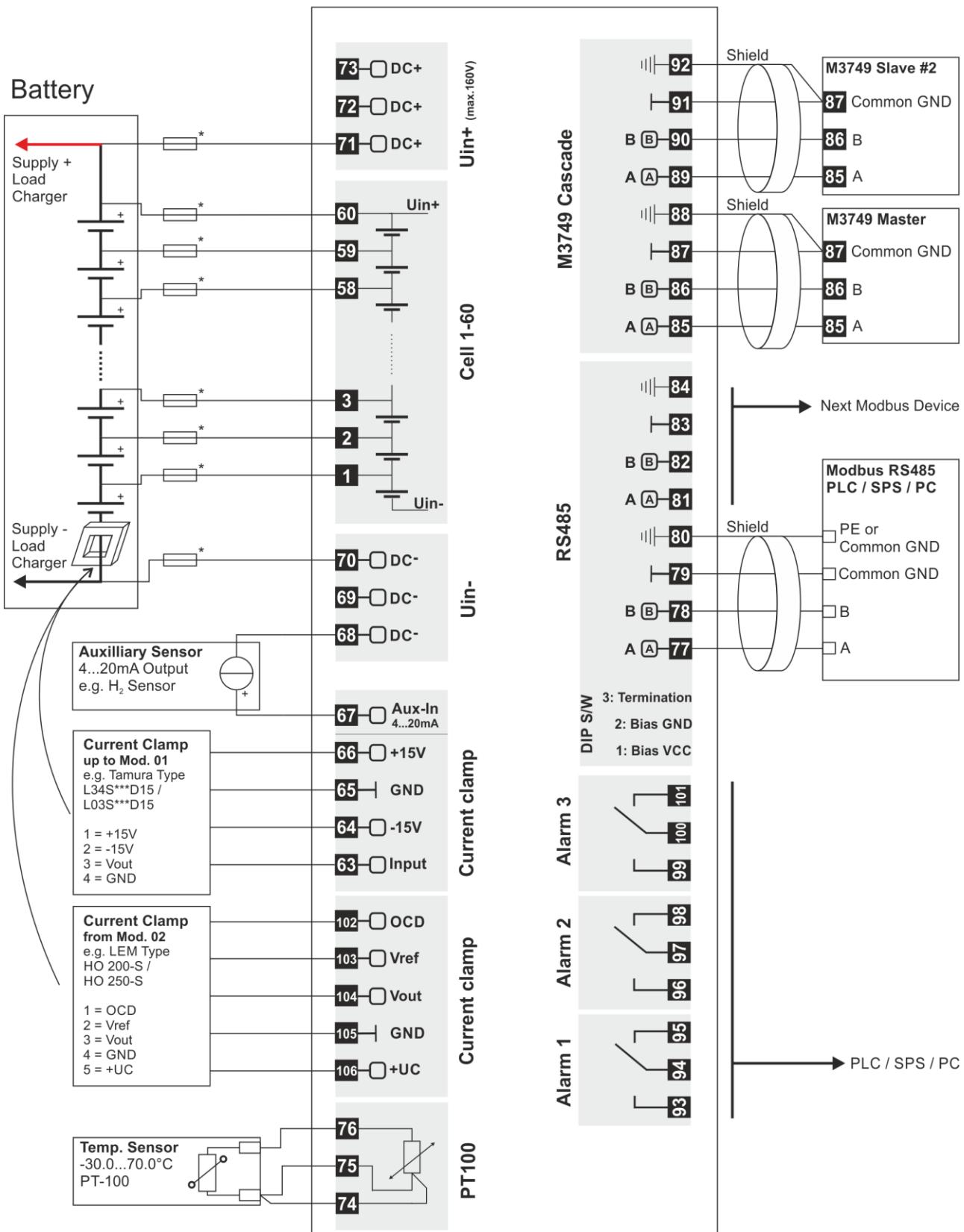
The RS485 interface are configured by the DIP switches as follows.

Switch	Use case
1 - Bias VCC	Turn on both switches if the device is connected with other transceivers without a "Failsafe" circuit. Bias resistor are 750E.
2 - Bias GND	Note: The device is equipped with a "Failsafe" transceiver.
3 - Termination	Termination between RS485-A and RS485-B for proper signal path. Termination resistor is 130E. Termination is required on both ends of the segment.

More information about the Modbus implementation refer the document "M3749_Battery_Monitoring_System_Modbus_UserGuide_Vx.xx.pdf" on the [Mostec](#) website.

9. Wiring

BMS Type M3749



*Use 0.5...1AT fuses. Wiring must withstand the fuse ratings.

10. Terminals

1-60	Battery cell inputs. Terminal 1 goes to the lowest voltage. Terminal 60 is the highest cell voltage.								
61	Protective Earth PE not connected to terminal 80,84,88,92	62	Protective Earth PE not connected to terminal 80,84,88,92						
63	Current clamp input	64	Current clamp -15V		65	Current clamp GND (DC-)	66	Current clamp +15V	
67	Auxiliary input 4...20mA based on (DC-)								
68	Supply + (DC+)	69	Supply + (DC+)	70	Supply + (DC+)				
71	Supply - (DC-)	72	Supply - (DC-)	73	Supply - (DC-)				
74	PT100-Sensor (+)	75	PT100-Sensor (-)	76	PT100-Sensor Sense(-)				
77	Modbus RS485 - A	78	Modbus RS485 - B	79	Modbus RS485 - Common GND	80	Modbus RS485 - PE not connected to terminal 61,62,88,92		
81		82		83		84			
85	M3749 Cascade - A	86	M3749 Cascade - B	87	M3749 Cascade - Common GND	88	M3749 Cascade - PE not connected to terminal 61,62,80,84		
89		90		91		92			
93	Alarm contact 1: normally open	94	Alarm contact 1: change over	95	Alarm contact 1: normally closed				
96	Alarm contact 2: normally open	97	Alarm contact 2: change over	98	Alarm contact 2: normally closed				
99	Alarm contact 3: normally open	100	Alarm contact 3: change over	101	Alarm contact 3: normally closed				

Current clamp for hardware version <= 02 (e.g. HO-Series or HOLY-Series from LEM)

102	Current clamp OCD	103	Current clamp Vref	104	Current clamp Vout	105	Current clamp GND
106	Current clamp +Uc						

11. Technical Data

Supply voltage:	20-160VDC, up to max. 300VDC on request
Power consumption:	Max. 5W
Power supply:	universal power supply 20 – 160VDC, for higher voltages connect the middle of the battery
Working temperature range:	-5°C to +45°C
Max. humidity:	95%, non-condensing
Mounting:	DIN-rail 35mm
Max. number of cells:	60
Max. voltage per cell:	0 – 160VDC, up to max. 300VDC on request
Cell input impedance :	1.04MΩ
Min. resolution of cell voltage:	3mV
Accuracy:	+/- 3mV @ 25°C
Long term stability(3 month period):	+/- 0.1%
Limit contacts:	<p>3 potential free change over contacts Trigger criteria's programmable in the instruments menu</p> <ul style="list-style-type: none"> - Status - Contact hysteresis: - Max. contact load: - Life span of contacts: <p>Symbol on the internal display Adjustable, factory setting is +/- 5 counts 1A resistive / 230VAC 100'000 cycles at max. load 10'000'000 cycles at no load</p>
Measurement input ripple voltage:	no need to connect this signal. The signal is directly measured from the instruments power supply connection.
Accuracy ripple current:	+/- 0.3%
Measurement input current:	depending on the requested maximum current, a current sense module is supplied.
- Accuracy current measurement:	+/- 0.1% gain error, Offset +/- 0.1%
Accuracy ripple current measurement:	- +/- 0.25% gain error, Offset +/- 0.1%
Temperature measurement:	-30 ... +70 °C, with external 3-wire Pt-100 temperature sensor
Accuracy:	+/- 0.1 °C
Pt-100 sensor cable length:	1000m, automatic cable length compensation
Hydrogen concentration input:	4 ... 20mA, measurement with an external hydrogen sensor
USB data logger:	accepts FAT32 formatted USB-sticks
USB Anschluss:	galvanically separated USB Type B connector for the connection between the Torkel or PC
Data connection to PLC / PC:	RS485, termination resistors selectable by DIP switches <ul style="list-style-type: none"> - Galvanically separated - Protocol: MODBUS RTU - Terminals for the cable shield and the connection to the next instrument on the same bus connection
Dimensions:	L x W x H = 213mm x 91mm x 62mm
Weight:	425g
CE-conformity:	fulfilled

12. Notes