Medium Charge-Controller for 15 A with extended Functions

In order to have a cost efficient but Powerful Solar Charge Controller, this device was developed.
It offers many additional features

Features:

➢ Up to 15 Amperes Charging Power using POWER-MOFET-Transistors.

➢ Overcharging-Protection of the Battery by fast Pulse-Wide-Modulation. This Mode gives better charging-results than slow Pulse-charging.

➢ Additional Input for charging of the Batteries with a 220 V / 12V or 24V Transformer

➢ Boost-charging from time to time (depending from the discharging level or at least once a month). Boost-charging avoids the degeneration of Liquid-Batteries.

➢ 80 % of the Batterys die from a degeneration of the Battery-Plates. Due to research-work of the University of Vienna, Austria and NASA, USA this degeneration can be reduced drastically by very short **High**

Current Pulses to the Battery. This charge controller is equipped with this feature, to extend life-time of the Battery.

➢ Deep-Discharge-Protection with up to three Outputs with max 3 x 10 Amperes. One MOSFET-Output and two Relay-Outputs can be used. So you have max. three times 10 A Output-Power.

➢ The Outputs can be programmed to be switched on only for a dedicated time (three hours in the evening for example). This is interesting in areas where the Capacity of the Batteries is reduced.

➢ **Small Power-Management-Function**: One channel can also be switched on by a Moving-Detector or a Switch or a Push-Button. The Delay-off Time can be programmed. With that you optimize your Energy-demand by switching off Devices Automatic if not needed.

➢ The two Relay can also be switched manually by the Device. They provide max. 10A, 220V. Instead of the Relay Power-MOSFET-Transistor can be ordered. They use less Power, but can provide only 12V/24V.

➢ Applicable for all Types of Lead- Batterys (Gel-Type etc.)

➢ Applicable for 12V or 24V-Systems. The System-Voltage is verified automatically. If you use the Relays, you have to order a 12V or 24V-Version.

➢ **Many Safety Precautions**:
  - High Temperature-Protection
  - Reverse-Connection Protection for the Solar-Panels and Battery
  - Automatic Short-circuit Protection for the Load, no more replacement of Fuses are necessary
  - Over-voltage Protection for the Input of the Solar-Panels
  - Protection for "no-Battery"-connection (if only Solar-Panels are connected, the voltage will raise very high)
  - No Reverse-Current to the Panels at night

➢ **Multistage theft-protection**. One Major Problem of Solar-Systems is the stealing of the Panels. This is a very serious Point for Solar-Systems.
  - With a Moving-detector: A Loud Alarm can be generated if somebody is coming close to the Solar-System
  - With an external Circuit: A high voltage is activated at the Panels-Frame as soon as somebody is coming close to the Panels. If somebody touches the Solar-Panels, he gets an electrical shock. Of course the voltage can not hurt anybody.
  - Optional the Alarm can generate a Telephone-notification to a Mobil phone

➢ **Small Power-Management-Function**: One channel can be switched on by a Moving-Detector or a Switch or a Push-Button. The Delay-off Time can be programmed. With that you optimize your Energy-demand by switching off Devices Automatic if not needed.

➢ Integrated **Charging-Unit for rechargeable NiCd, NimH**-Batterys (2 x Type AAA and / or Type AA), which can be used for Radios, Torches etc. 12V chargers for this application are very rare! There is a option to charge NiCd/NimH-Batteries instead of Lead-Batteries with higher current.

➢ Optional: One short-circuit-protected Voltage Output with a fixed voltage of 5 V or any other if needed. For to connect small Radios or TV directly to the Unit.

➢ Three LED's for to Display Battery empty, Solar charging and NiCd/NimH-Charging

➢ By a Program-Switch some functions like Battery-Type etc. can be programmed. You can also activate a Simulation-Mode for the Battery-Voltage.

➢ For Data-Logging a PC or Notebook can be connected (via serial cable or USB with Adapter). The Battery-Voltage can be logged and evaluated (By Excel for example)

➢ Easy update of new Software by a small Program and the Data-Cable.

➢ Optional you can have your own Functions integrated in the Unit. Let us know what you need and we Program it. And you can even load another Software for using this Unit for another purpose (for a Irrigation-System or for a Alarm-System for example)

Functions of the Program-Switch

0: Alarm-System off
1: Alarm-System active
2: Programming-Mode: Lead-Gel-Battery (= 1) or Liquid-Lead-Battery (=0)
3: Programming-Mode: with Short High-Current-Pulses (= 1) or not (=0)
4: Programming-Mode: with NiCd/NimH-Charge-Controller (=1) or not (=0)
5: Programming-Mode: Load on for x hours
   (0 = Function off, that means the Load is active, as long as the Battery is not empty).
6: Relay 1 manually on
   Programming-Mode: Delay Time (in hours) for the Load Output to be active after the sun is down
7: Relay 2 manually on
   Programming-Mode: Time Delay off (in minutes) for the Load Output which was activated by Moving-Detector or Switch
8: Select NiCd (=0) or NimH-Battery (=1)

Electrical Wiring
Connect the cable according to the List at the end of the Document and according to the Wiring-Diagram.

Solar Charge Controller

If the battery is relatively empty, the yellow LED for Solar Charging is on, all Energy from the Solar-Panel is transferred to the Battery.
If the Battery gets full, the Charge Controller switches to fast Pulsation-Mode (PWM), the yellow LED starts flashing.
If the Battery is full, the yellow LED is switched off, charging is switched off.
From Time to Time the Battery-Voltage is raised to Boost-Voltage, for to avoid degeneration of the Battery. For this Function the Battery-Type has to be programmed (See Programming of the Battery-Type).

Programming of the Charge-Controller

2: Lead (Liquid-Battery) or Lead-Gel-Battery
Select Program-Switch *Position 2*
Press Push-Button until LED starts fast flashing.
Then Program-Switch to
Position 0: Lead (Liquid-Battery)
Position 1: Lead-Gel-Battery
Save Settings by pressing of the Push-Button until the LED Stops fast flashing

3: Short High-Current-Pulses
Here you can activate the **Short high-current-Pulses** to extend the life-Time of the Batteries (see Features)
Select Program-Switch *Position 3*
Press Push-Button until LED starts fast flashing.
Then Program-Switch to
Position 0: Short high-current-Impulse off
Position 1: Short high-current-Impulse on
Save Settings by pressing of the Push-Button until the LED Stops fast flashing

Deep-Discharge Protection

If the Battery is empty, the Output Load is switched off delayed, the red LED is on. As a pre-Warning the red LED is flashing when the LED is relatively empty. Five minutes before the Load is switched off, the Load is switched off shortly as a Pre-Warning.
There are three Load-Outputs available, each can provide 10A. If the Program-Switch is not in Position "0" or "1", the two Relay are switched on as well and also 220V Devices could be switched.
Additionally a daily Time can be programmed, to activate the Outputs, for example every evening for three hours etc. See below for more Information about that.

Please connect the Inverter only up to 100 Watt to the Charge Controller. Above that the Inverter has to be connected direct to the Battery. There is an automatic switch off of the Inverter in case of low Battery.
The Transistor-Output (12V/24V) is shipped with an automatic Fuse.
The Relay-Outputs have no internal Fuse! You have to provide a external Fuse for Safety!

Programming of Functions for the Load-Outputs

5: Timer-Function
For to Save Energy you can have the Outputs switched on only for a defined Time in the evening.
Select Program-Switch *Position 5*
Press Push-Button until LED starts fast flashing.
Then Program-Switch to
Position 0: Function off, Outputs are always active as long as the Battery is not empty.
Position > 0: Time in hours for the Load Outputs active after Sunset.
Save Settings by pressing of the Push-Button until the LED Stops fast flashing

6: Programming Delay Load on at night
Program-Switch at *Position 6*.
Press Push-Button until LED starts fast flashing.
Then Program-Switch 0-11 is the Delay-Time in hours after the sun was going down and the lights are switched on.
Save Settings by pressing the Push-Button until the LED Stops fast flashing

7: Output active after alarm or activation by Moving-Detector or Switch or Push-Button
Program-Switch at *Position 7*.
Press Push-Button until LED starts fast flashing.
Then Select Position 0-11 which corresponds to the time in minutes how long the Output is active.
Save Settings by pressing the Push-Button until the LED Stops fast flashing

NiCd/NimH-Charge-Controller

With this Charge-Controller, NiCd/NimH-Batteries (Type AAA and AA) can be loaded. If the Batteries are relatively full, the green LED is flashing. It stops if the Battery is full. The Batteries can stay in the folders without problems, if the voltage drops, charging is restarted automatic.

Programming of the NiCd/NimH-Charge-Controller

4: NiCd/NimH-Charge-Controller
Here you can activate the NiCd/NimH-Charge-Controller.
Select Program-Switch *Position 4*
Press Push-Button until LED starts fast flashing.
Then Program-Switch to
Position 0: NiCd/NimH-Charge-Controller off
Position 1-11: Program the number of NiCd/NimH-pairs you use. If there are 4 Batteries, enter "2" for 2 pairs.
Save Settings by pressing of the Push-Button until the LED Stops fast flashing

8: Select NiCd (=0) / NimH (=1)
If you have NiCd/ NimH connected for loading, you have to select which type of Battery is connected.
Program-Switch at *Position 8*.
Press Push-Button until LED starts fast flashing.
Then Program-Switch to "0" for NiCd and "1" for NimH.
Save Settings by pressing of the Push-Button until the LED Stops fast flashing

9: NiCd / NimH as Main-Battery
You can also have NiCd / NimH loaded instead of the Main Lead-Battery. But in this Case there must the internal Temperature-Sensor be good connected to the batteries. And keep in mind that NiCd / NimH-charging is working different from lead charging. After Start charging you have different Stop-Conditions for Stop charging: with max. Time, with max. Voltage, with Delta Voltage, with max. Temperature, with Delta-Temperature. Then it starts recharging when the voltage drops below a certain value.
Programming with Program-Switch at *Position 8*.
Then Program-Switch to "0" for Standard charging

or "1" for NiCd / NimH as Main-Battery.
Save Settings by pressing of the Push-Button until the LED Stops fast flashing.
This Feature is not yet fully tested! Contact me for Details!

Alarm-System (Optional)

If you have a Alarm-Sensor (Moving-Detector) and a Alarm- Horn connected, you can activate the Alarm-System with the Program-Switch:
Switch Position 0: Alarm-System off
Switch Position 1: Alarm-System on and the Alarm is active after a delay of 30 seconds.
If the Moving-Detector detects Alarm, Relay 1 is switched on delayed, Relay 2 without delay. After a time, the Outputs are switched off again. This time can be programmed if the Programm-Switch is in Position 7. Look at " Connect the Hardware according the Wiring-Diagram. It does not matter if it is a contact with normally closed or normally open.

Power-Management

Switch in Position 2
Works almost like the Alarm-System. But the Outputs are activated without a delay. This function can be used to save Power by letting devices work only if needed, for example a lamp in a toilette.

Fixed Voltage Output (Optional)

If needed, you can have a stabilized fixed Voltage Output (5V or any if ordered).
Connect the cable according to the List at the end of the Document and according to the Wiring-Diagram
You can take max. 1 Amperes from this Output

Loading by a 220V / 12V or 24 V Transformer

You can load the Batteries by a 220V / 12V or 24 V Transformer (up to 1 Ampere) as well. Charging is controlled for not overloading the Battery.

Simulations-Mode
If you switch the Push-Button during start-up, you are in Simulation-Mode and you can simulate the Battery-Voltage and the switching-Points. By the serial Interface you can monitor the voltage.

Monitor Values with LogView

Logview is a excellent Software (Freeware) to Monitor and evaluate Process-Data. This Device sends the Measurement-Values such as the
Battery-Voltage
NimH-Voltage
in the Logview-Format and you can evaluate them.

Short Overview about the Features of Logview
View of Process-Data in Graphic
View of Process-Data in Table-Format
Evalate the Data in Real-Time
Comparison of Curves
The Design can be changed
Intuitive workaround
Integrated RTF Editor
Graphic-Editor
Export-Funktions:
Table-Format: CSV, ASCII, HTML, RTF und Excel
Graphic-Format: BMP, JPG, GIF und PNG

Installation

Install Logview with LogViewInstaller from the CD (Folder \LogView) or the latest Version at the Internet:
www.logview.info/cms/d_logview-21.phtml

Download the file Metamor_Solar_Medium_e.ini from the Internet (www.alternative-technology.de and the according Application) and you have to copy it to the folder
C:\Documents and Settings\your User-Name\Application Data\LogView\Geraete\OpenFormat\

Start Labview
Select Device at Menu „Device, choose Device and Port" the according Device: Metamor_Solar_Medium_e
Select according serial COM-Port as well

At Menu File, Settings, Program select the following:
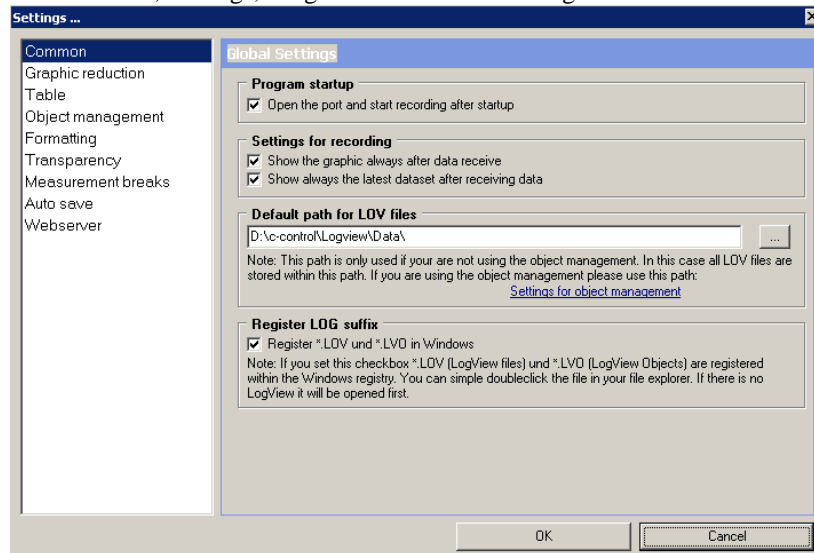
In the Default path for Log-Files the Log-Files are stored. You can modify it. These Files can be checked later on just by double-click
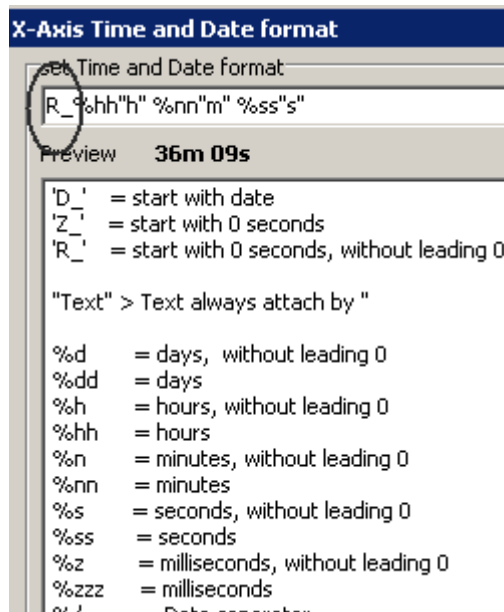
Registrier Log suffix should be checked that you can start Logview by direct clicking the *.lov file.
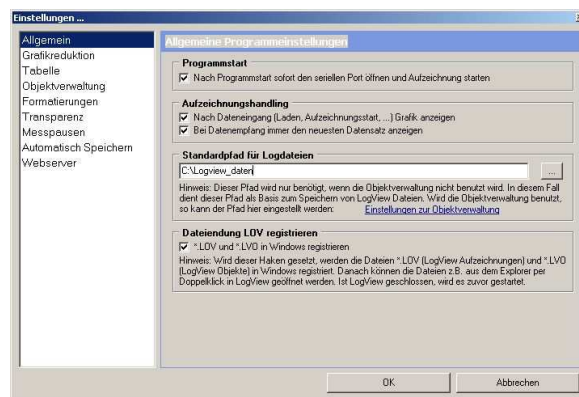
Then you can start the recording. In the Life-Window Data should come up.

If you want to have the actual Time being displayed in the Curves
Select Menu Grafic, Zeitformat der X Achse, then ontop instead of R_ make D_ and save.

X-Axis Time and Date format

Set Time and Date format

R_%hh"h" %nn"m" %ss"s"

Preview   36m 09s

```
'D_'  = start with date
'Z_'  = start with 0 seconds
'R_'  = start with 0 seconds, without leading 0

"Text" > Text always attach by "

%d    = days,  without leading 0
%dd   = days
%h    = hours, without leading 0
%hh   = hours
%n    = minutes, without leading 0
%nn   = minutes
%s    = seconds, without leading 0
%ss   = seconds
%z    = milliseconds, without leading 0
%zzz  = milliseconds
```

More Infos in the online-Manual of Logview and the Internet under www.logview.info

Hints

- ➢ If you press the Push-Button by mistake and you are in Programming mode, the Mode will be disabled after one minute.
- ➢ If you use a 24V-System also the Relay and the Moving-Detector has to be ordered for that voltage.
- ➢ If you use the High-Voltage-System as Theft-Protection, you have to mount a Warning-Sign.

Loading of new Software

To load new Software into the Unit you have to Start the Program „**BootLoader.exe**“ (on the CD in the Tools-Folder).

- ✓ Connect Data-cable to Serial Port. If you have no serial Port, install the USB-serial-Adapter first.
- ✓ Start the Program, Select Options „19200 Baud“ and the according COM-Port.
- ✓ Then „File“, „Select File“ and navigate to the according *.bin file.
- ✓ Then „File“ „Upload“
- ✓ If only "Sending #123" appears, switch the Device off and on (Remove battery cable and reconnect).
- ✓ If still no Download-Window is popping up, something with the cable is wrong or with the Metamorphose

Specification, Technical Data

Mega168 with 16K Flash-Memory, 512 bytes EEPROM, 1K RAM, 3 timers / Counter, 6 analogously input 10 bits, one serial-Port, I2C-Port,	
Program-Switch	yes
serial port	1
Bootloader, to load new Software by serial-Port	yes
LED-Lamps (Solar charge, NimH-Charge, Batt.empty)	3
free analogue-Inputs	3
Load-Output	1 with 15A, 12V/24V
Relay-Output	2 for 12V/24V/220V
max.Current Relay-Output	10 A
optional Impulse-Relay (only needs Energy by switching)	yes, optional

Loading lead-batteries by external power adapter	yes, optional
Loading lead-batteries by solar / wind Power until max.	15A
Pulser for lead-batteries to the extend lifetime of the battery	yes, optional
PWM-Output 12V / 24V (Pulse-width-Modulation)	yes for Solar
NiCd/NimH-Charger	yes, optional
Data recording by serial interface	yes, battery and NimH-Voltage
Evaluate the data with the software LogView	yes
Output auxiliary-Voltage fixed 10V, 0,5A	yes, optional
Output auxiliary-Voltage variable (by resisitor), 0,5A	yes, optional

Terminals

Terminals inside

Terminals left		ext.Wiring	Terminals right		ext.Wiring
1	free		21	+5V	**Moving-Detektor Contact**
2	free		22	+5V	**+5V' NTC Temp-Sensor**
3	Minus	**Charge by Transformer Minus**	23	12V out	**Moving-Detektor +12V/Relay 12V Outp.**
4	charge 15V+	**Charge by Transformer 12-15V +**	24	ADC2(PC2)	**Temperature-Sensor**
5	+12V in		25	ADC3(PC3)	**(Solar-Voltage, internal)**
6	+12V Out	**Bridge to Terminal 13 if 12V Load**	26	ADC4(PC4)	**Moving-Detektor Contact**
7	Micro+		27	Relay 1 NO***	**Alarm-Horn Output (220V or 12V*) delayed**
8	Micro+		28	Relay 1 in	**Alarm-Horn Input (220V or 5V or 12V*)**
9	Minus		29	Telephone	
10	Minus		30	Telephone	
11	Minus	**Lamp Output Minus**	31	free	
12	Relay 2 NC**		32	LM317/12V+	
13	Relay 2 in	**Lamp Input 12V/24V/220V**	33	Minus	**Moving-Detektor Minus**
14	Relay 2 NO	**Lamp Output +12V or 220V**	34	Minus	**Horn Minus**

Problems, Questions, Suggestions….

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