

***Universal Solar Charge-Controller with extended functions
"All in one"-Solution for the Solar-Management.
Can be used for Wind-Power as well***



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Background

Solar-Systems have very much charm. They are build up in few days and supply electrical Power for many years. They are maintenance-free, which is very important for the countries of the south. Only the battery must be changed all 5 to 15 years (depending of the quality). In addition they do not have the environmental pollution (exhaust gases) or noises of a generator and do not have the regularly costs of gasoline, oil etc. The initial costs are higher, but on the long term it is interesting.



Remarks

We do not say that everything of the Metamorphosis is already perfect. But we appreciate all hints and remarks to improve the Hardware (Case) and Software. "The Software is alive" and also your ideas and proposals can be implemented and transferred to you. You find the last Version of the Software in the Internet. (see Chapter "Loading of new Software"). Contact me if you have questions. The Address is at the end of the Document.

Not all Functions are realized in every Unit. Look for your Order what is implemented in your Unit In the document "Hints_Solar_Technology.doc" on the CD or in the Internet you find many information about Solar-Technology.

Safety

- First connect Battery, then the Solar-Paneels, then the Load. Do not Reverse-Connect the Battery, Solar-Cells and Load!
- 12V/24V Outputs have an internal Fuse; But 220V Outputs are not shipped with a Fuse! You have to provide an external Fuse for Safety!

Quick Start

- The Load-Output-Voltage is not regulated. That means it can change between 11,5 V - 14,4V (24 V-System: 23V till 28,8V).
- If the Battery-voltage is not correct, it can be modified in Menu 8, Parameter 47,
- The charge controller can be mounted close to the Batteries, to have a exact voltage and temperature.
- You can mount the Device on the wall using the two holes in the Cooling-Units.
- The Inverter should be connected direct to the Battery with short cable. The Inverter switches off if the battery is empty. See the Appendix for the electrical wiring.
- Not all external Terminals are wired. They can be wired according to your specific wishes.
- Switch on the device and select with the Program-switch in the middle which values you want to have on the Display.
- Select your Battery-Type (Gel and Lead-Gel) in Menu 8, Parameter 11
- Note that actual Values of Ah etc. take at least 10 Minutes to take effect in the Display.
- If the Battery-voltage is not exact you can fine-tune it with Menu 8 Parameter 47, Value 1.
- If the Solar- and Load-Current is not displayed exactly, you can make a correction in Menu 8 Parameter 48, Value 12-14. But the value has limited accuracy due to renunciation of a Shunt in order to improve System losses.
- Keep the cable between Charge-Controller and Battery short. If that is not possible, you can try to make a correction by Menu 8, Parameter 71 and 72 to compensate the Cable-losses.
- If you install the Software MP_Remote from the CD (Folder \PC_Remote_Control) you have an easy access to all Documents and Parameters.
- If you select a high tracking rate for the measured values, you can have a delay in reaction. 1 minute should be ok for tracking.

All the possibilities of the Metamorphosis might confuse you. Don't worry, it is good to know what is possible. And then let us know, what we should activate for you. Just connect your Solar-Panel and Battery and switch on.

All Parameters are preset in the right way according to your order. You only need to modify may be the battery-type or if you want some other options or adjustments.

Keyboard-Functions

In the Basic-Menu when a message is displayed, you can acknowledge this message and switch off the horn by pressing any key.

From the Basic-Menu (the menu on the display after being switch on) you can select different **Sub-Menus** by pressing the key 1 to 9. In the Sub-Menus you can jump from one value to the other by pressing “#”. The flashing Cursor indicates which value is active for Input. So if you input wrong data, press “#” several times until you come again to the desired value. In Menu 1 (Universal-channel) you can go back one Input-field also by key “*”.

If you changed the value you can go directly back to Basic-Menu without pressing “#”

Go back or return from the Submenu by pressing “*”. From Menu 1 (Universal-channel) you return by pressing “*” twice.

Basic-menu

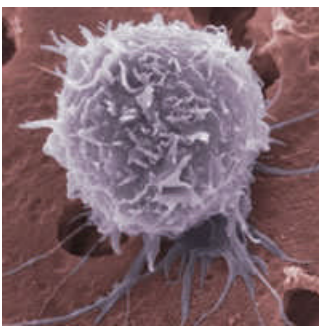
After switching the device on you see the Basic-Menu. You can switch the values displayed in here with the Program-Switch in the middle of the Metamorphosis

You have the following options:

- Position 1: Battery-Voltage, Solar-Current, Battery-Voltage as a graphical bar
- Position 2: Battery-Voltage, Solar-Current, Solar-Current as a graphical bar
- Position 3: Battery-Voltage, Load-Current 1 (Load 1+2) and Load-Current 2 (Load 3-5) and Load Current 3 (external Load). Load 1+2 as a graphical Bar
- Position 4: Battery-Voltage, Solar Ah/day and Ah Totalizer. You can reset the Totalizer by pressing "0"
- Position 5: Battery-Voltage, Load Ah/day and Ah Totalizer. You can reset the Totalizer by pressing "0"
- Position 6: Battery-Voltage, Output Solar in Watt, Output Load in Watt
- Position 7: Ah Solar und Ah Solar / day.. You can reset the values by pressing "0"
- Position 8: Ah Load 1 (Load 1+2), Ah Load 2 (Load 3-5), Ah Load 3 (external for example from Inverter), Ah Load Total . Second Line: Ah Load Total / day. You can reset the values by pressing "0"
- Position 9: Minimal, maximal Voltage / day. You can reset the values by pressing "0"
- Position 10: KWh from external Energy-Counter if connected. You can reset the values by pressing "0" Voltage of NimH-Batteries if connected. Temperature and Time.
- Position 11: State of Charge and active Battery-Bank. Here you can switch over manually the Battery-Bank with key "#" and then select the Battery-Bank-number 1-3. Finish with key "*" or switch over Program-Switch.
- Position 12: Radio-Sensors if they are connected

Note: The flashing "" in the first line indicates that the Solar-charging is active.*

Menu 1 = Universal Channel 1-20 for Load-Shedding, Alarms and many more Functions



A stem cell is most fascinating! The cell can realize different functions and tasks, depending on which is activated. Simultaneously it is in close contact with other

cells and communicates intensive.

The universal module "Soft Cell" works a bit in the same way. It can take realize different tasks, includes the most important basic functions and is in close contact with the other modules to exchange information. All modules have the same structure.

Background: Individualized software is very expensive and often not very flexible for necessary changes or adjustments. To save costs and to give customers more flexibility and transparency, this universal module "Soft Cell" was created. It is thus possible by an excel sheet to realize a variety of different functions without the need to program it.

Here you do have a Multi-Purpose-Function for up to 20 different Modules.

Hint: In the Appendix you find an Excel-Sheet for to make the planning more easily. You find it on the CD or in the Internet.

In Menu 8 Parameter 27 you setup the number of Channels used. This value should correspond to the number of values you are using for better Performance!

In the Menu Universal Modules you can jump one Input-field back with key „*“. If you wait a little bit and press „*“ again, then jump to the next field back. Two times key „*“ (without break) jumps back to the main Menu.

Overview of the functions of the Universal module in menu 1

Timer: Device switched Time-controlled (f.e. fridge only at daytime, light only at night etc).

Start once for a defined Time: You just setup the running-time of the Timer and then switch the channel on. The Output is active just once for the defined time. After that the channel is switched off.

Pulses: Device switched with Pulses. Every minute for 10 seconds or every Monday for 3 hours etc. For example for a generator start etc.

The above Time -Function can be combined with all other functions.

Simulation of absence: Often Solar-Systems are installed where people are often absent. You can program a Timer to switch on lights for to simulate the Presence of somebody

Load-shedding: Different Loads can be switched off depending from the Battery-Level. With delay switch on and delay switch off (minimum run-time). With Hysteresis (Difference-value between on and off). This can be used for Load-shedding of the Devices connected. First the less important, then the critical ones. Example: Channel 1-5

Voltage-Control: Switch on devices if the battery is full etc. For example for to use all Power of the Solar-Panels to switch a Water-Pump etc. With delay on/off and Hysteresis.

Output Delayed off: for example to switch on a light by a switch and turn off automatic to save Power. The Start can be by a Push-Button or a Switch.

Example: Channel 7-11;

Alarm-Messages and Action: For example if any Value (Voltage, Temperature) is inside a critical range a Alarm can be activated and / or a Telephone-call, SMS etc. Example: Channel 6, Battery empty

Alarm-System: Using moving-Detectors etc. or door-switches (in the cabinet etc) you can build up a Alarm-System for to protect your equipment. Alarm can be by a Siren or a Telephone-call or a SMS if you have a Mobile-Phone connected. Example: Channel 7-11

Cooling: For example the solar panel. You can Input the Temperature-Setpoint with Hysteresis and Pulses for the cooling-pump. Example: channel 12

Heating: For example a glass-house if it may not get too cold. With Temperature-Setpoint and Hysteresis.

Level-Control with analog Sensors: for example for the Tank of the cooling water.

Level-Control with 1 or 2 digital Sensors: for example refill for a certain time if the empty Level is coming.

Interlock with an Input: Pump only active if no empty-Level.

Interlock with an Output: Dosing only active if the Pump is running.

Difference-Regulation: For example for Solar-thermal Systems for the Temperature-Difference-Regulation

Activating Channel by SMS

If you send a SMS with the Text Meta81 or Meta91 to the Metamorphosis, you can activate a Universal-channel by selecting Input 90 (for SMS with the Text Meta81) or 91 (for SMS with the Text Meta91). If all conditions are ok and you send the SMS the output will be switched on. By Sending the SMS with the Text Meta80 or Meta90 the Module is deactivated again

In each Module you can define two Inputs and two Outputs. Inputs can be analog or digital, Outputs Relais or Transistor or virtual, to be used in other Modules. Or it can be a Telephone-notification.

Presetting of the Channels

Channel Function		Type	Setpoint Analogue-Value			Delay	Delay	Input 1	Output 1	Input 2	Output 2	Hysteresis						
Nr	Type	On/Off	Type	Name	Actual	</>	Set-Value	Unit	on	off	Nr	Name	Nr	Name	"=1/=0"	Nr	Name	Hysteresis
1	Load Shedding 1	On	0	Batt-Voltage	x	<	11,5 V		30 s	80 s	1	Batt-Voltage	1	Load 1	0	0	0	1 V
2	Load Shedding 2	On	0	Batt-Voltage	x	<	11,3 V		30 s	80 s	1	Batt-Voltage	9	Load 2	0	0	0	1 V
3	Load Shedding 3	On	0	Batt-Voltage	x	<	11,1 V		30 s	80 s	1	Batt-Voltage	10	Load 3	0	0	0	1 V
4	Load Shedding 4	On	0	Batt-Voltage	x	<	10,9 V		30 s	80 s	1	Batt-Voltage	11	Load 4	0	0	0	1 V
5	Load Shedding 5	On	0	Batt-Voltage	x	<	10,7 V		30 s	80 s	1	Batt-Voltage	12	Load 5	0	0	0	1 V
6	Alarm Batt empty	On	10	Alarm	x	<	10,7 V		30 s	80 s	1	Batt-Voltage	0	0	0	0	0	1 V
7	Alarm 1 Motion-Detector	On	14	Alarm	x	<	512		15 s	60 s	3	Analog 3	4	Relay 4	0	0	0	0
8	Light on by Motion-Detector	On	4	Alarm	x	<	0		0 s	240 s			2	Relay 2	105	Digital 5	0	0
9	Light on by Motion-Detector	On	4	Alarm	x	<	0		0 s	240 s			3	Relay 3	106	Digital 6	0	0
10	Light on by Motion-Detector	On	4	Alarm	x	<	0		0 s	240 s			5	Relay 5	107	Digital 7	0	0
11	Light on by Motion-Detector	On	4	Alarm	x	<	0		0 s	240 s			6	Relay 6	108	Digital 8	0	0
12	Cooling Solar-Panels	off	1	Temp	x	>	40 °C		10 s	20 s	5	Analog 5	6	W-Pump	0	0	0	5 °C
13	Cleaning Solar-Panels	off	40		x	<	0		0 s	0 s	0	0	6	W-Pump	0	0	0	0
14	Add.Device on at Batt.full	off	0	Batt-Voltage	x	>	13,8 V		30 s	3 s	0	Batt-Voltage	3	Relay 3	0	0	0	1,5 V
15	Interlock W-Pump	off	24	Interlock	x	>	0		10 s	80 s	0	0	6	W-Pump	102	Leer	0	0
16	Windgen. Storm-Protection	off	3	Solar	x	>	12 A		5 s	103 min	14	I Solar	7	Relay 7	0	0	0	1 A
17	Circulation-Pump on Solarthermal	off	1	Temperature	Tank	<	Solar-Temp °C		30 s	30 s	12	T-watertank	2	Pump	63	Temp Solar	0	0
18	Circulation-Pump off Solarthermal	off	21	Pump off	Tank	>	Solar-Temp °C		30 s	30 s	12	T-watertank	2	Pump	63	Temp Solar	0	0
19	Temp.Max. Pump off Solarthermal	off	21	Interlock. T max	x	>	85 °C		10 s	10 s	12	T-watertank	2	Pump	0	0	0	1 °C
20	Temp.Max. 2.Pump on Solarthermal	off	1	T Pump 2 on	Tank	>	95 °C		10 s	10 s	12	T-watertank	3	Pump 2	0	0	0	1 °C

Channel Function		Timer			Pulse on all x min for..				n.Alarm in	
Nr	Type	hr	Min	for	Unit	on for	Unit	all	Unit	x min
1	Load Shedding 1	0	0	0		0		0		0
2	Load Shedding 2	0	0	0		0		0		0
3	Load Shedding 3	0	0	0		0		0		0
4	Load Shedding 4	0	0	0		0		0		0
5	Load Shedding 5	0	0	0		0		0		0
6	Alarm Batt empty	0	0	0		0		0		3
7	Alarm 1 Motion-Detector	0	0	0		0		0		3
8	Light on by Motion-Detector	18	0	212	hr	0		0		0
9	Light on by Motion-Detector	18	0	212	hr	0		0		0
10	Light on by Motion-Detector	18	0	212	hr	0		0		0
11	Light on by Motion-Detector	18	0	212	hr	0		0		0
12	Cooling Solar-Panels	0	0	0		15	s	10	min	0
13	Cleaning Solar-Panels	4	0	102	min	0		0		0
14	Add.Device on at Batt.full	0	0	0		0		0		0
15	Interlock W-Pump	0	0	0		0		0		0
16	Windgen. Storm-Protection	0	0	0		0		0		0
17	Circulation-Pump on Solarthermal	0	0	0	sec	0	s	0	s	0
18	Circulation-Pump off Solarthermal	0	0	0	sec	0	s	0	s	0
19	Temp.Max. Pump off Solarthermal	0	0	0	sec	0	s	0	s	0
20	Temp.Max. 2.Pump on Solarthermal	0	0	0	sec	0	s	0	s	0

How to Program the Channels?

With key "1" from the Basic-Menu you select the Universal channels.

First you select the according Channel-Nr 1-20.
Then you can switch the Channel on and off (enable / disable)

Next to this you see the actual Status of the Channel Output (on or off)

In here the Alarm-Zones can be defined with

121 = Group 1 released

140 = Group 20 released

142 = all group <2 released

160 = all group <20 released

See below for more information.

Channel should work one by one subsequently

The channels (max. 5) can work one by one in cycles, for example to have the load (washing machine, dishwasher etc) not all at the same time.

11 = on if pulse 1 active. Time Pulse 1 = Delay off of the channel

12 = on if pulse 2 active. Time Pulse 2 = Delay off of the channel

....

15 = on if pulse 5 active. Time Pulse 5 = Delay off of the channel

Typ: With Type you define whether it is a

0: Battery-voltage Unit V

1: Temperature-Control, Unit °C

2: Level-Control or Dosing, Unit %

3: Current-Control (A)

4: no Unit

5-9: Reserve

20-29 = Interlock

Like type 0-9 however in this case the Output is only reset by the conditions. That means you can use this function for an Interlock (Reset Pump if the Level is empty)

30-39 = Impulse

Like type 0-9 however in this case after activation the Output is switched on only for a certain time (delay-on time). Thus for example a light switch can be used to switch on the light only for a certain time.

Should this work also at switching off of the Switch then you have to use another channel and check Input 2 for "active if Input = 0".

40-49 = Load-Shedding channel

like type 0-9 however in this case it is a load shedding channel (like channel 1-5). The difference is that the Output is deactivated after the condition is fulfilled (for example Voltage < 11,0V)

50-59 = PI-Controller

Like type 0-9 however with this Type you can realize a PI-Controller with Analogue Output for 12V/24V or 110V/220V (Phase-Loop-Control)

Type 70-79: Alarm-channel

Such as type 0-9 only but as alarm-channel. That means if the channel is enabled by a analog or digital input, it is waiting for a time specified in the "delay on"-value. During this time, the alarm can be turned off by Menu 3. If this is not the case, a alarm is activated. This may be a relay or a phone call, if the channel has specified the output number "16" (Output 1 or 2).

The time how long the Alarm is active is defined by the time "delay off". Then, a delay time is started (defined in "next alarm in" in minutes) until the alarm system is active again.

You can define an alarm text for the LCD-display or for a SMS. This Text can be defined by specifying a number 41-48 at Output 1 or 2. The text can be Input by the Excel-file "channels", Tab "Input/Output". The text is defined at Output 17-20 corresponding to Alarm-Text 41-48.

Alarm-Zones

For to build up an alarm system different zones or groups (areas such as inside, outside) can be defined for the channels (see up). These Zones have to be Input now at the "On"-Switch in the first menu of the channels by a value of 121-140 (121-140 = zone).

This value corresponds with the value in the menu 8 parameter 31 "enabled Zone". Then only these

corresponding channels are active. Furthermore, a value can be entered from 141-160 as described above.

Input "0" at enable Zones means all Zones are off.

Input 1 means all Zones are on, activated.

For a alarm system that would be a 24-hour Alarm for critical things.

Alarm groups

121 = Group 1 released

....

140 = Group 20 released

142 = all group <2 released

.....

160 = all group <20 released

Setpoint

If you press “#” again you have the next Menu for to define the Setpoint:

Display: **12.8V<SP:11,5.V**

First you see the **Actual Value**, you can not change.

Selection </>

It allows you to define whether the Output should be active if the Actual Value < Setpoint –Hysteresis (for example switch off Devices if the Battery is empty) or if the Actual Value > Setpoint + Hysteresis (for example switching on a device if the battery is full). Input 0 or 1 to change

SP: Here you define the **Setpoint**. The Unit depends from the Type in this Menu.

If you enter “0” then the Function “Analogue Sensors” is disabled and is only Time-Controlled or by Input 2

Hysteresis

Display: Hys: x.y

For the Setpoint you can define a **Hysteresis** for the Switch Back-Point. For example 1.0 V.

If you make a small Hysteresis the Output is switched frequently.

Comparison of two measured values (temperature difference)

In this case, an analog input must be specified at Input 2 (51-65 Input for analog 1-15).

Now two measurements are compared. If the value is above the Setpoint, the output is switched.

This is interesting for a solar thermal plant for example. In this case the temperature of the tank and the solar collector must be compared.

The first temperature is the temperature of the solar collector (input 1), the second temperature of the water reservoir at input 2.

At Input 2 the Measured-value Temperature is displayed now.

Following calculation takes place:

If the panel temperature - water tank-Temperature is greater than the Setpoint, then the circulation pump is turned on.

If panel temperature - water tank is less than the target value - Hysteresis, then the circulation pump is switched off.

If ">" is entered in the comparison, then if the first measured value is more than the second measured value (at input 2) the output is activated.

In the case of the solar thermal system the first Input is the collector temperature, the second Input the tank temperature.

If "<" is entered in the comparison, then if the first Measuring is less than the second measured value (at input 2) the output is activated.

The second input can be an external set-point.

Delay on/off

If you press “#” again you have the next Menu **Delay on/off:**

Here you can define a **Delay-on** Time for to activate the Output. This is interesting if the Actual-Value is very unstable.

Here you can define a **Delay-off** Time in seconds for to Stop the Output delayed. This is interesting if the Actual-Value is very unstable and you want to have the Output on at least for a certain time for example for Load shedding etc.

For “Delay on” and „Delay off“ the value can be defined in seconds (Input 1-99), minutes (Input 1.01-1.99) or hours (Input 2.01-2.99). Example: 1.07 means 7 Minutes.

- In case of Alarm this is the Time how long the Alarm-horn is active
- You can also see the actual value for the Delay in here.
- Disable this function with Value "0".

Timer



Note: For using the Timer-Function, you have to enter the actual Time first in Submenu 7.

You can enter the **Start-Time** for Output x. First you enter the hour (0-23) for Start of the Channel Output. Then press “#” and you can input the minute you want to have the Output been started.

With the next “#” you can say **how long** you want to have the Output running:

If you enter “0” then the Output will be started only depending from the other conditions

If you enter a value from 1-99 then the unit is in seconds.

If you enter a value from 101-199 then the unit will be in minutes. For example value 1.02 means 2 minutes.

If you enter a value from 201-255 then the Unit will be hours. For example value 2.03 means 3 hours.

Pulses

Here you can define whether the Output should be pulsed (all minute for 20 seconds etc)

On all:

If you enter for example 10 for “all..” it means that every 10 minutes the Output is activated for the Time in “on for”

Range for “on all”

1-99 = minute

101 -124 = 1-24 hours

201-255 = 1-55 days

Example: If you want to have the Output on all ten minutes and for 30 Seconds on: You input 30 Second at “on for” and 10 (10 minutes) at “on all”;

If you do not want to have the Timer or the Pulses set the according values to “0”

Alarm in x min

If you define the Channel as a Alarm, you can Input a break-time till the next Alarm is activated.

Input/Output

If you press “#” again you have the next **Menu Input/Output:**

Display: **Input:101 (33+44) Range: 1-204**

Output:1 (35+36) Range: 1-15

Here you select the according Input:

Analogue Input 1-15

SMS-Input: Input 90 and 91

Digital Input 1-8 (Enter 101-108)

Radio-Sensor 1-4 (Enter 201-204)

In Line 2 you select the according Output (1-15) whereas

Output 1 and 8-14 is a Transistor Output (only 12/24 V)

Output 2-7 is a Relay Output (also 110/220V)

Output 15 is the Relay for charging NiCd/NimH

Output 16 activates a Telephone-call (In Menu 5 you define the Telephone number)
Output 17-20 are virtual Outputs for to be used in other Channels as Interlock etc.
Output 24 is for to generate a SMS. According Number is in Menu 5
Output 25 is for to start the generator

In () you see the Terminals where you have to connect your wires for 12V/24V. For 110V/220V you have to look the wiring plan.

Next Menu: **Input 2**

Here you can select an additional Input as another Start-Condition

Display: In2:1/101 (33+44); (33+44 = Terminal-Number)

Range:

Interlock by Digital Output: 1-20

Another Analogue Input: 51-66 (for to make a Difference-Measuring of two Analog Inputs)

SMS-Input: Input 90 and 91

Activation by a Digital Input 1-8: Enter 101-108

Activation by Radio-Sensors 1-4: Enter 201-204

If you have two Digital Sensors (two Level-Sensors) you can select the according Digital Input (101-108) or Radio-Sensor (201-204) in here.

For example for a Level-Control: Input 1 switches the Output on, Input 2 switches it off.

The actual Status for the Input 2 is displayed after “:” (1 in this example).

Input 2 can also be a **Interlock or Enable-Signal** by an Output from another channel. In this way you can combine different channels.

Select 1-20 for the according Output (17-20 are virtual Outputs, no Hardware for that).

Example 1: no Irrigation if Rain-Sensor of Channel 6 is more than xy and Humidity of channel 1 is more than 50 %.

For that you select in Menu 1 Channel 6 (Channel for the Rain-Sensor) as Output Nr 17.

In Menu 1 Channel 1 (Humid-Channel) you select this Output 16 as Input 2 (additional Start-condition).

Example 2: If you want to have a **Dosing-Channel** you can define here which other Output (Irrigation-Output) must be on during Dosing.

Input 2 can also be a second Analogue Input. In this way you can compare two Analog-Values and the Setpoint will be replaced by the external Analog-Value.

Example: Activate if Temperature-Difference is more than 15 °C

Input 2 can also be a **Interlock or Enable-Signal** by a Input. (no Irrigation if Level min). Select 101-108 for the according Digital Input or 201-204 for Radio-Sensors.

If you want to use only Input 2, Set Input 1 to "0"

With this Settings you can have **the following Options:**

Input 1 < 100 and Input 2 = 0: Analogue Switch

Input 1 > 100 and Input 2 = 0: Digital Switch with one Sensor

Input 1 > 100 and Input 2 > 100 : Digital Switch with 2 Sensors

Input 1 < 100 and Input 2 < 100: Analogue Switch with Enable by Channel 1-15

Input 1 < 100 and Input 2 > 100: Analogue Switch with Enable by Digital Input 1-8 (101-108)

In () you see the Terminals where you have to connect your wires.

Display: Input ok = 0/1?

Here you can define whether the Channel should be active (Output = 1) if Sensor Input = 1 or if the Sensor Input = 0. This depends from the Type of Sensor or if you want to have an Interlock or Enable-Function by Input 2.

Output 2:

Here you can define a second Output. Could be also a virtual Output for Interlocking with other Modules. In this way you can realize a interconnection of the different modules.

Range:

Output 1 and 8-14 is a Transistor Output (only 12/24 V)
Output 2-7 is a Relay Output (also 110/220V)
Output 15 is the Relay for charging NiCd/NimH
Output 16 activates a Telephone-call (In Menu 5 you define the Telephone number)
Output 17-20 are virtual Outputs for to be used in other Channels as Interlock etc.
Output 25 is for to start the generator

Adjust the PI Controller

- Set desired target value and reduce system deviation to zero in manual operation mode
- Switch to automatic mode
- Increase KP slowly until control loop tends to oscillate at small variations of target value
- Slightly decrease KP until oscillations are eliminated
- Decrease TN until control loop tends to oscillate again
- Slightly increase TN until oscillation is eliminated

Menu 2: Generator Start/Stop

For this the Option Generator must be activated in Menu 8, Parameter 20

See Wiring-Diagram for the electrical connection

Start/Stop of the generator

The generator can be started manually (press “1” in Line 1) and Stopped as well from here (Press “0” in Line 1)

The generator can be started by Timer as well. For that program one Channel in Menu 1 with Output 25 and define the Start and Running-Time.

The generator can also be started by Battery empty. For that program one Channel in Menu 1 with Output 25 and define the Start-voltage of the Battery at Setpoint with Condition “<”. The Hysteresis is the Difference-voltage for to Stop the generator again.

By Menu 8, Parameter 30 you can let the generator start by Voltage or by SOC (State of charge). The Voltage or SOC-value has to be defined in Parameter 31. To enable this start you have to Set in Menu 2 Parameter 5 “Start by U min”. In this way you can Start the generator by voltage using Menu 8 Parameter 30 + 31. Or the universal-Modules.

The generator can be started by SMS as well with the SMS-Text “Meta81”. Then you have to define one Module in Menu 1 with Input 81 (for SMS Start) and Output 25 (for Generator).

Stop the generator with SMS-Text “Meta80”.

A running generator must be stopped by first sending Meta81 (if not done before for to start) and then “Meta80”.

Time running can also be finished by Menu 2 Parameter 4: Max. Time on.

You can also Start and Stop the Generator from external Switches. See Wiring-Diagram for according electrical connection. Stop can also be a Alarm-Signal like no-Oil-Alarm etc.

If you do not have an electrical Start, you can also generate an Alarm. With Menu 8, Parameter 66 you can activate this function.

There are three Start-Trials and then you will have a Alarm-Message. Confirm it with any key.

To protect the Motor the Load is switched on delayed after Start Motor (when the Motor is warm). And the Load is switched off some time before the Motor is shut down (for cooling of the Motor without Load). This increases the Life-time of the engine.

There are three run-Time hours counter for Output of Alarms for Maintenance etc. You can define a limit for this Alarm and the counter can be Reset by Input of "0" at the counter value.
With key "#" you jump to the next fields.

Settings:

You have the following Functions in Menu 2:

Generator on/off:

With Key "1" you can manually Start the Generator. As long as there is no feedback from the Generator "on" will be flashing. With "0" you stop the Generator

Run Time 1/2/3: xx hrs:

You have three Counters for the running time of the Generator and each one generates an Alarm. These could be used for Maintenance-Purpose etc. You can select each Counter if you press key "#" to jump to the according field and then enter 1 or 2 or 3.

If you press "#" again to jump to the next field you can reset the according hrs with "0".

If you press "#" again you have another Menu (Parameters):

Parameter 1: Limit 1: 100hr: Here you give the Set point for the Alarm 1 after xxx hrs Generator running time

Parameter 2: Limit 2: 1000hr:

Here you give the Set point for the Alarm 2 after xxx hrs Generator running time

Parameter 3: Limit 3: 2000hr:

Here you give the Setpoint for the Alarm 3 after xxx hrs Generator running time

Parameter 4: Max.Time on:

Here you give the Setpoint for the max. Running-Time of the Generator after one Start. If you do not need this function, set this value to "0"

Parameter 5: Start U min?:1/0:

Here you select whether the Generator should Start Automatic when the Battery is empty ("1"). Parameter for Battery empty is Menu 8, Parameter 31

Menu 3a: Alarm-System active/inactive, Zones

To protect the precious Solar-System you can build up a Alarm-System (with Telephone-notification) as well. The Alarm-channels are defined in Menu 1. The channel-Type has to be 70-79. For Telephone-Notification you define one Output with "16".

If the charge-controller is located in a box, you can protect the System by wiring a door-switch to the Metamorphosis (see the Appendix for the electrical wiring).

To activate the Alarm-System switch to "On". After a delay of about 90 seconds the Alarm-System is active.

If it is activated, there will be a Alarm-Signal from the Metamorphosis if one of the Sensors detects Alarm. You can connect a loud external horn to the Metamorphosis and it will be activated. If you have a telephone-line connected, the Preset Telephone-Numbers will be dialed. If you have a Mobile-Phone connected, a Alarm-SMS will be send or just a phone-number is dialed up. (see Appendix for how to connect all this devices)

Alarm Zones

Furthermore Alarm-groups can be defined in here, also for to activate groups of Modules in the Universal-modules.

Input 121-140 = Zone 121-140. If in menu 8 parameter 31 a corresponding zone is defined, the corresponding channels are active.

Furthermore, a range of Channels can be defined with value 141-160. "145" means for example that all channels with a zone greater than 140 and less than 145 are active.

Menu 3b: Scan-Time for Data-logging

With the key "#" you jump to the next Input-field in this Submenu.

Here you can enter the time, how often the desired measurement-values are written in the internal Memory.

If you enter a value from 1-100 then the unit is seconds.

If you enter a value from 101-200 then the unit will be minutes. For example value 102 means 2 minutes.

If you enter a value from 201-224 then the unit will be hours. For example value 203 means 3 hours.

The quantity of values stored in the Metamorphosis is limited to about 4500 (2500 for the M128). According to this value you can calculate the Scan-Time for to have Data for x days.

Example: If you scan the Solar-Voltage and Solar-current every 20 minutes (that's enough because these values do not change that fast) you can have up to 30 days of data-logging.

Menu 4: Load-Shedding off for Emergency

In order to have a Emergency-light although the batteries are empty, you can activate a Emergency Load-Shutting Temporarily off. Now the Output will be active for a dedicated Time although the batteries are empty.



But be aware that batteries get seriously damaged if they are excessively deep-discharged.

Press "1" for to activate this function and 0 for to deactivate it.

This Function can be activated by an external Switch (Input 3) as well.

Menu 5: Input and Test of Telephone-numbers

For to use this function you need to have a GSM-Modem or a Mobile phone connected.

You can enter two telephone-numbers in here. These numbers are dialed in case of Alarm.

First you select which Telephone number you want to Input (1-2). Press "#" to jump to the Input-field of the Telephone-number. You can enter a 12 digit number now. If you want to enter the next Telephone-number press "#" again, select Nr.2, press "#" and enter the number in the Input-field.

If you want to test it, press "#" and select "1" at the Test-field.

If you want to have all numbers being dialed subsequently enter "12" for the Number-Selection and leave the Sub-Menu.

If you want to have only one specific number being dialed, enter the desired number (1-2) in the field for the Number-Selection and leave the Sub-Menu.

To have no call enter key "0" at Number Input.

Depending of Parameter 5 in Menu 8 a Telephone-call is initiated or a SMS is activated,

To cancel a call enter the key "*".

Menu 6: Tracking on/off, Input of the Tracking-Time and Start/End-Time

If you have a mechanical construction that lets your Solar-Panel follow the sun position in one or two axis, you can use this automatic for to get it turn. The benefit from letting the Solar-Panel follow the sun position in one axis is up to 30%!

General: Tracking is realized by a Formula for the X-Axis (Horizontal) and by a Table for the Y-Axis (vertical).

You have a Switch for to activate it in Menu 6.

And the time for Start and End Solar Tracking (SR/SS).

The Tracking-Increments are calculated by: $\text{Tracking-Time Total} / \text{number of Increments (Time between SR and SS)} + \text{Slip (Menu 8, Parameter 37)}$. All 30 minutes there is a Tracking. At the End-Time (SS) + 2 hours the Unit is going back to Basic-Position for max. Tracking-Time + Time Rotate back (Menu 8, Parameter 38) or till the Final Switch (see wiring diagram) is 1-Signal.

Following Parameters are relevant:

on: Here you activate this function "Solar tracking" with key "1". The Motor is activated every half an hour for a specific time. And in the evening the Motor is switched on reverse for to go back to the Base-position. This Position can be detected by a final-switch (see the Appendix for the electrical wiring).

SR (Sun Raise): Here you enter the hour for Sunrise.

SS (Sun Set): Here you enter the hour for Sunset (for example 19 for 19 o'clock). From Time to time you can readjust these values

Time: This is the Tracking-Time. In here you enter the value how long it takes for the Tracking-Unit to go from Base-Position to the Final-Position. You can figure out this value by going to Manual-Mode (Menu 9) and switch the Motor on manually (R6 on) and measure the time for a complete turn from beginning to the End. This value (in seconds) you have to enter in here.

In Menu 8, Parameter 37: **Rotate Slip:** Here you enter the delay for every starting at Tracking (about 3 sec).

In Menu 8, Parameter 38: **Time Rot.back:** Here you enter the additional Time (Tracking-Time + X) it takes for to go back in Base-Position. But this is the Max-Time! Going back to Basic-Position should be stopped by a Proximity-Switch (Signal 1) at Input 1 (Terminal 47+48). If no Proximity-Switch is coming, it stops with this time and a Error-Message is generated

If you do not have the correct tracking in the horizontal direction correct the rotate time in Menu 6

For Horizontal Tracking Relay 5, 6 is used and can not be used for any other purpose (Generator, Alarm etc.)

In Menu 8, Parameter 36 you can also activate a **vertical Tracking**. This runs according to a Table. In this case Relay 3, 4 is used and can not be used for any other purpose (Generator, Alarm etc.).

If you do not have the correct tracking in the vertical direction correct Menu 8, Parameter 39

Menu 7a: Input of Date and Time

For the Protocol, the Timer and the Tracking-Function you have to enter Data and Time in here. The fields are month.day, hour:minutes and you jump from one field to the other with the key "#". You can also input the Week-day in here. Monday could be Number 1.

Note that the Time is Reset when you switch off the Metamorphosis.

Menu 7b: Output Voltage

Here you see the Value of the Output-Voltage coming from the integrated optional Voltage-Regulator. You can adjust this Voltage with the right Regulator next to the Program-Switch. This voltage can be used for to connect small appliances like Walkman, CD-Player etc. to the Metamorphosis. The Output-Range is 3-12V with up to 2A.

Be careful not to change the voltage when a device is already connected. Overvoltage can destroy the Device! (see the Appendix for the electrical wiring).

Here you have for testing purposes more Displays depending from the Program-Switch:

PWM-Value (Solar)

Slow Switch (on-Time per Minute for Solar)

Boost-Ch. (Pulses)

Ma I2C PWM (Bus Master-Value)

SL I2C PWM (Slave values)

Menu 8: Settings

In this Submenu you can change a lot of different parameters and values if you are not satisfied with the Pre-settings. First you select the Number of the Value (see list below). Then you press "#" and you can enter the according value. The next value is selected by simply pressing "0" in the field of the Parameter-Number or by entering the desired Parameter-number. That means with just pressing "0" at Parameter-Nr you can scroll through all the values.

You can also reset it to the Factory-Settings by Parameter 70.

Following Parameters can be changed:

1 Analogue Range Start

If you select Type 4 in Parameter 26 you can setup the Range by Parameter 52-55.

You can do this if you measure two Input-values (Analogue Range Start and End) and look at the according values in the Menu 8 Analogue in.

At Parameter 1 you enter the Start-value

2 Analogue Range End

Here you enter the End-value

3 Analogue Raw Start

Raw-Value Start reads the value in Menu 8 Analogue for the according Start-Value of the channel

4 Analogue Raw End

Raw-Value End reads the value in Menu 8 Analogue for the according End-Value of the channel

5: Send SMS

Here you can activate the Function to send a SMS in case of Alarm (by the Universal-Module with Output 16 for example). After an Alarm you have a break-time which is defined in the according channel (about 3 min)

6: Voltage for Battery full

At this voltage charging is normally finished (Presetting 13,8V)

7: Cycle Loading Gel-Battery

Up to this voltage the Gel-battery is charged from time to time (Boost-charging) to improve the Performance of the Gel-battery (Presetting 14,4V)

8: Cycle Loading Lead-Acid-Battery

To this voltage the Lead-Acid battery is charged from time to time (Boost-charging) to improve the Performance of the Acid-battery (Presetting 14,7V)

9: Maximum Voltage

At this voltage charging is switched off in any case (Presetting 15,0V)

10: Language

You can select now between English (=1) and German (= 0)

11: Battery-Type Gel-Type or Lead-Acid

Select key "0" for Gel-Type batteries

or "1" for Liquid Lead-Acid-Batteries.

If the Battery-Type is changed, all standard-Settings will be loaded for this Type

12: Channels Relay Solar

Normally this Value is "0". But if you have the Relay-Version of the Charge-Controller you can select how many Relays are used for Solar-Charging. You can have up to four channels with 15A each. If you don't have the Relay-Version of the Charge-Controller, set this value to "0" and the Relays are free for other purpose

13: Channels Load

Here you can define how many independent channels you use for the Load (max. 5). In Menu 1, Output you can define whether this Output is a Transistor-Output or a Relay-Output.

15: Hysteresis additional Device on (if Battery full)

With this parameter you can activate the function to have another device being switched on if the battery is full (for example a water-pump etc). After the Battery-Voltage indicates full (Parameter 6), the Additional Device is switched on. Here you select the Hysteresis-Voltage for switching it off again.

With "0" this Function is deactivated.

With Parameter 76 you define whether the additional Device is always active or only for xx min/hr.

According Output is defined in Parameter 53.

See next Parameter for more Options.

16: Umax -> add.Device on for x min/hr (0=off)

Here you can define a Time, how long an Output should be on, after being activated by Battery full (Parameter 15). This is interesting for Devices which should not be switched on continuously. Here you define the Time on in minutes / hour. Set this Value to "0" if the Device should be on the whole time after the Battery is full.

20: Generator

Setting this Parameter to "1" activates the Generator-Function in Menu 6. In this case Relay 2, 3, 4 is used for Start/Stop of the Generator and can not be used for any other purpose (Alarm etc.). Look for the extra Schematic for the electrical wiring.

21: PWM-charging

If you set this value to "1", you will have a fast PWM-Charging mode. Setting this value to 0 enables the slow pulsation-mode. If you have the Relay-Version it has to be set to "0" . Standard is "1"

22: Receive SMS

You can switch on and off Relays by sending a SMS to the Metamorphosis.

In this case the Automatic is switched off for this Relay

For to switch you have to send the following SMS-Text to the Metamorphosis:

Switch on Output 1: Meta11
Switch off Output 1: Meta10
Switch on Relays 2: Meta21
Switch off Relays 2: Meta20
Switch on Relays 3: Meta31
Switch off Relays 3: Meta30
Switch on Relays 4 :Meta41
Switch off Relays 4: Meta40
Switch on Relays 5: Meta51
Switch off Relays 5: Meta50

Switch on Relays 6: Meta61
Switch off Relays 6: Meta60
Switch on Relays 7: Meta71
Switch off Relays 7: Meta70

Switch back to Automatic (all by SMS activated Relay are free again for the Automatic): Meta00

After activation a Relay by SMS you get a SMS for Acknowledge

Using this option you need a Siemens Mobile-Phone with Modem (S25, S35, C35 etc). And you need to activate in Settings "FAX-Data-Mode receive" and "SP/Data-Mode send". And also deactivate IrDa and "Sprechgarnitur". No other communication (to Logview etc) may be active on the serial Port of the Metamorphosis. For to be sure switch off and on the Unit.

23: Factor for Simulation by regulator

Here you can enter a Factor for Simulation by regulator (if you have this Option). With this Value the Simulation-Value is multiplied.

Simulation is realized by the knob next to the Program-Switch. The factor is multiplied with the value coming from the knob, so you can adjust any value you need for any analogue Input. Simulation is activated by pressing key "*" during switch-on. But with Parameter 18 and 19 you have a digital Simulation as well.

24: Correction-Value for high Current Solar

If the Display for Current Solar for high currents is not correct you can define a factor in here:
Input-Value = Displayed Value – peak Current of the solar-cells (see plate for this information)

25: Time Boost charging

To increase the Performance of the Batteries it makes sense to keep the Boost-charging to 14,4V/28,8V for a longer time. But you should check the loss of liquid and refill if necessary. Normally Boost-charging last 2 hours. After a manual change of this time it has to be set to 2 hours after increasing, otherwise Batteries can be damaged. Value is in minutes.

26: Typ Analogue Input

Here it can be specified for each analogue input, what for a type of sensor is connected.

You have the following types:

Type 0: Voltage

Typ 1: NTC 10 K

Typ 2: LDR (Light sensitive Sensor)

Typ 3: linear (z.B. Level 0-100%)

Typ 4: free definition due to parameters 1-4 in menu 8

Typ 5: internal: NiCd/NimH-Voltage

Typ 6: internal: Battery-Banks

Typ 7: 0-20mA-Sensor

Typ 8: 4-20mA-Sensor

The input Range is 1-15

See appendix for the Inputs

27: Number of universal channels in menu 1

Here the number of universal channels in Menu 1 can be specified.

Maximum number: 20.

28: Number of NiCd/NimH-Cells

If you enter the number of NiCd/NimH-Cells in series (Standard) in here you can activate the Function "Charging of NiCd/NimH".

Corresponding Parameters: 29, 73, 74

29: NiCd/NimH Capacity

Here you Input the "mAh-Value" of **one** cell of the NiCd/NimH-cell you want to load. You find it printed on the batteries. But if two cells are in parallel then you have to enter two times the Capacity. (f.e. 2*2300 mAh = 4600 mAh).

30: Generator Start V/ SOC

Should the Generator Start depending from the SOC (State of Charge) then Input "1" or depending from the Battery-Voltage (=0).

31: Start Generator at...

Start-Level for the Generator depending on SOC (State of Charge)

32: Load switch off by V/SOC

Switch off Load depending from SOC (State of Charge = 1) or Battery-Voltage (= 0)

33: Correction SOC

If the SOC (State of Charge)-Value in the Basic-Menu is not exact, you can correct the value using the Correction-Factor.

For example: Display is 30%; Real Value is 10%; Correction-Faktor = $10\% / 30\% = 0,33$

34: Adjust Solar Current

This value is adjusted that you have a display of 0 A if there is no sun. If that is not correct, press "#" in here and again "#". The value should be about 563 and can not be changed manually.

35: Temp-Corr U Batt

If no Temperature-Sensor is connected and the Analog-Input should be used in another way, this Parameter can be set to "0"

36: Rotate Y-Axis (vertical)

If you activate this Function, there is also a Tracking of the Y-Axis according to a Table. That means half of the day it is moving to one direction, the other time back to the base-Position. In this case Relay 3 and 4 is used and can not be used for any other purpose (Alarm etc.)

37: Rotate Slip

Here you can enter a Slip for Rotation. This value is added to the Increments to rotate every half an hour. So if the rotation is not exact (going too far or too less in the evening), you can modify this value (for example 20 Seconds)

38: Time go back horizontal

Time for going back to Basic-Position horizontal

39: Amplifying factor horizontal tracking

Here you can Input a factor for horizontal tracking (0.1 to 100,0). If there is too little or too much tracking you can corrected as follows:

20% to less tracking: Input of 1,2

20% too far tracking: Input of 0,8

40: Running time Output x

Here the number of an Output can be defined, for which the running time is detected and displayed. For example the running time of a pump for maintenance purposes.

Here also the actual values are displayed (in minutes and seconds)

If in this parameter a new Output is defined or set to „0“, the value is deleted.

By the universal channels in menu 1 a message can be generated or another action can be activated if you define as Input number "18" (=running time in minutes max. 32767).

This Output is then sent to LogView as well (16. Parameter) if the data are send directly to the PC (start by MP_Remote). Thus you can determine exactly when the Output was on and off.

41: Hardware-Version

This value is Preset and corresponds to the Hardware of your board. Do not change!

42: Solar charge on/off by Time

Switch off the Solar-Panels at night by Time. This function is relevant for example if you have Relays connected and there is no detection for the Solar-Current. The on/off-Time is defined in Menu 6 by the Sunrise (SR) / Sunset (SS)-Value.

43: with SD-Card (0/1)

If a MMC or SD Memory Card is installed for long-Term Data-Archive, set this Parameter to "1". If you set it to "No" and then "Yes" again the Pointer is Reset.

44: Scan Analogue Inputs (0-15)

Number of Analogue-Channels to be logged. Preset: 2

If the number has been changed, a restart of the Unit is necessary.

Overview:

1= U battery in V

2= I Solar in A

3= Ah Solar; in Ah

4= I Load 1 in A (Load 1+2)

5= I Load 2 in A (Last 3-5)

6= I Load 3 in A (external)

7= Temperature (Sensor 4)

8= Pulse Counter

9= Voltage NiCd, NimH

10= Wind-Speed

11= Radio Temperature

12= Radio Humidity

13= Radio Rain

45: SD-Chip Block-Nr

Internal value for to Display of the Block-Nr written on the SD-Memory Chip. This value can be changed.

46: Dynamic Switch off Voltage-Level

Dynamic Switch off Voltage-Levels on all channels according to the history before. This gives a more accurate Battery-Empty Detection. Here you can activate this function.

47: Analogue Input correction +/-

For fine-Tuning (for example for the battery voltage) in parameter 47 and 48 an adjustment can be realized.

According to the formula $y = mx + b$ ($m =$ upward gradient, $b =$ zero crossover) each linear measured value can be adjusted.

Change parameter 47 (+/- Factor) if the value is somewhat inaccurate for low and high value.

Change parameter 48 (* Factor) if the value within the lower range is correct however in upper range not.

Analogue input 1-15 see list in appendix

Measured value 1 is the main battery voltage, which can be corrected here. For the fine correction of the battery voltage I would proceed like that:

Input the difference between displayed value and real value (checked by a Voltmeter) in here. If the value should be negative press key „0“ first. For 0.2 enter simply 2. For 1,1 enter 11. Check and readjust again.

More important correction values:

Measured value 9 is the Voltage battery bank 2

Measured value 10 is the Voltage battery bank 3

See the actual voltage in the basic menu if the program switch is in position 11. Then Input key „#“ and select 1-3 to see the according voltage and switch to the according battery manually.

48: Analogue Input correction Factor

Here a multiplication factor can be setup, if the value within the lower range is correct however in upper range not.

Analogue input 1-15 see list in appendix

The preset value is 1.0

Analogue Input 13: I-Load Corr 1

If the Load-Current Block 1 (Channel 1, 2) is not exact, you can correct the value using the correction-Factor.

For example: Display is 5.0 A; Real Value is 4,5 A; Correction-Faktor = $4,5A / 5A = 0,90$

Analogue Input 12: I-Load Corr 2

If the Load-Current Block 2 (Channel 3-5) is not exact, you can correct the value using the correction-Factor.

For example: Display is 5.0 A; Real Value is 4,5 A; Correction-Faktor = $4,5A / 5A = 0,90$

Analogue Input 11: I-Load Corr 3 (external)

If the Load-Current external Sensor (f.e. Inverter) is not exact, you can correct the value using the correction-

Factor.

For example: Display is 5.0 A; Real Value is 4,5 A; Correction-Faktor = $4,5A / 5A = 0,90$



Electrical connection external Current-Sensor: Terminal 78 und Terminal 42 (Minus)

Analogue Input 14: I-Solar Corr

If the Solar-Current is not exact, you can correct the value using the correction-Factor.

For example: Display is 10.0 A; Real Value is 5,0 A; Correction-Faktor = $5A / 10A = 0,50$

49: Number of Battery-Banks (0=off)

With this Unit you can charge three different and independent Battery-Banks. If the first Battery-Bank is full (Parameter 6) a Delay-Time is started (Parameter 50). After that the next Battery-Bank is activated Automatic. With this Function you can make a kind of Battery-Station to load Batteries of different capacity and quality.



Take care: If you use this Function, the max. Current for Battery-Bank 1-3 is 15 A

See extra Sheet for electrical connection of the Battery-Banks

Bank 1: Connect to Terminal Battery + and Battery -;
additional for **Charging** connect Minus to Terminal Load 3-

Bank 2: Plus direct from Solar or Terminal Battery-Bank 1 +
Minus to Load 4 -

Bank 3: Plus direct from Solar or Terminal Battery +
Minus to Load 5 -

When you get the Device wiring is prepared only for one Battery-Bank. For to activate up to three Battery-Banks following has to be rewired: Remove cable from Solar Out to Battery – and connect it to Load In (other side of Unit).

Furthermore one cable for charging Battery-Bank 1 has to be wired from Battery-Bank 1 Minus to Load 3 -

More Parameters corresponding Battery-Bank:

49: Number of Battery-Banks (0=off)

50: Delay Battery Full (in min)

51: U min -> back to the 1. Battery Bank (0=off)

52: Select Battery-Bank manual

54: Correction current Battery-Bank 2

55: Correction current Battery-Bank 3

60: Output Battery-Bank 1

61: Output Battery-Bank 2

62: Output Battery-Bank 3

Parameter 47 Value 9 is the correction-Factor for Battery Voltage Bank 2

Parameter 47 Value 10 is the correction-Factor for Battery Voltage Bank 3

50: Delay Battery Bank full (in min)

Here you can Input a Delay-Time in minutes after Battery Bank x is full, to switch over to the next Battery-Bank.

51: U min->Switch to 1.Batt.Bank (0=off)

If you use several Battery-Banks and it should be switched back to the Main-Battery in case of low Battery, you can define this Battery-Voltage in here. Set this value to "0" if you do not use the function.

52: Select Battery Bank manual

The Battery-Banks can be switched over manually as well. This can be done in the Basic-Menu with Program-Switch at Position 11. Press key '#' to select a new Battery-Bank. The Automatic Switch over to the next Battery-Bank is disabled in this Mode.

53: Output (0-16) Battery full->Device on

Select according Output-Nr (Relays Outputs or MOSFET); Preset: 3

See Appendix for more Information about the Outputs

54: Correction factor battery bank 2

Here a Correction factor (e.g. 1,03) for the current Display battery bank 2 can be Input. This value is multiplied by the Display:

Setup: Set Value to 1,0. Then measure the current and compare with the Display

Example: Display is 5,0 A; measured value is 4.5 A; Korrektur-Faktor = $4,5A / 5A = 0,9$

55: Correction river battery bank 3

Here a Korrektur-Faktor (e.g. 1,03) for the Display of battery bank 3 can be Input. This value is multiplied with the Display (see Parameter 54)

56: Correction solar current for not PWM charging

Here a correction-factor (e.g. 1,03) for the solar current Display can be Input if no PWM charging is active, that means if the voltage is less than 12,8V/25,6V. This is sometimes necessary if the normal current correction by parameter 48, channel 14 is not generating satisfying Display.

This value is multiplied with the Display.

Example: Set Value to 1,0. Then measure the current and compare with the Display Display is 5,0 A; measured value is 4.5 A; Correction-factor = $4,5A / 5A = 0,9$

57: Output (0-16) Start Motor: Select according Output-Nr (Relays Outputs or MOSFET); Preset: 3

List of Outputs see Appendix

58: Output (0-16) Stop Motor: Select according Output-Nr (Relays Outputs or MOSFET); Preset: 4

List of Outputs see Appendix

59: Output (0-16) Generator Load: Select according Output-Nr (Relays Outputs or MOSFET); Preset: 2

List of Outputs see Appendix

60: Output (0-16) Battery-Bank 1

Select according Output-Nr (Relays Outputs or MOSFET) for Battery-Bank 1, if you have several Battery-Banks; If you have only one Battery-Bank, set this value to "0"; Preset: 0

61: Output (0-16) Battery-Bank 2

Select according Output-Nr (Relays Outputs or MOSFET) for Battery-Bank 2, if you have several Battery-Banks; If you have only one Battery-Bank, set this value to "0"; Preset: 0

62: Output (0-16) Battery-Bank 3

Select according Output-Nr (Relays Outputs or MOSFET) for Battery-Bank 3, if you have several Battery-Banks; If you have only one Battery-Bank, set this value to "0"; Preset: 0

63: High Current Pulses on/off

80% of the Batteries die due to degradation of the Plates. The University of Vienna, Austria and NASA developed a Device for drastically reducing this effect by applying short high-current Pulses to the Battery. Here you can enable and disable the High Current Pulses to extend the lifetime of the Battery, if your Device is shipped with this Option. These Pulses do not need much Energy.

64 : Network: off / Master / Slave (Connect several Units by a Bus)

You can let run several Metamorphosis synchronized with this Function. This enables a synchronized charging of big Battery-Banks, what is otherwise not easy to achieve. The Devices have to be wired accordingly (see below). There is a Master-Charge-Controller (Set Parameter 64 to 1) and one ore more Slave charge-Controller (Set Parameter 64 to 2). If the cable is broken, the Unit switches automatic to self-controlled charging. You can control the Bus in Menu 7, Program-Switch to 5 (for Master) and 6 (for Slave). These values have to be the same after some time.



Electrical connection: for Synchronizing more Units connect Terminal 84/85/86 to next Unit Terminal 84/85/86 etc.

65: Correction KWh (0,0...9,9) (for the Energy-Counter)

Factor for to correct the KWh-Value of the Energy counter; It means the quantity per Impulse. Preset: " 1.0 "

66: Alarm at Start Generator (0/1)

If there is no Automatic Start Generator a Alarm can be activated in here, if the Generator should be started;
Preset: " 0 " = off

69: Correction Time

Here you can Input a correction-value for the Time in second if necessary. This value will be corrected once a day at midnight (Preset: 50).

70:

Standard-Settings

If you set this value to "1" the Standard-Values will be loaded for all Parameters. So your specific Settings will be overwritten. But you can backup your Parameter with the MP_Remote-Software to the PC.

71: Correction Cable length

Having long cables from Battery to charge-controller (more than 5 m) the cable length can be Setup here to get a more exact battery voltage measurement. With "0" the function is deactivated.

72: Correction cable diameter

If a correction of the battery voltage by Parameter 71 was done, the cable diameter must be Input in here (in mm²).

73: NiCd or NimH

Here you specify which Type of Accumulator you do have, NiCd (= 0) or NimH (=1). This corresponds to the switch-off-Voltage.

74: Charge NiCd / NimH by Power-Mosfet

Relevant if NiCd or NimH-Type Batteries are the Main-Battery. In this case you can charge the NiCd or NimH-Accumulators with a high current using the Power-Mosfet-Transistor instead of charging Lead-Batteries. In this Mode the Temperature-Sensor has to be close to the Batteries as a switch-off criteria. NiCd / NimH-Batteries are charged in a different way as lead-Batteries: After Start of charging there are different criteria for finish loading: After a max. Time, max. Voltage, Delta U-Change, max. Temperature, Delta-Temperature-Detection). After that charging starts again if the voltage drops below a certain value.

75: Sending of logged Data to LogView

Logged Data from Analog-Inputs can be uploaded to Logview. Switch this value to „1“ to upload. After Transfer of all data this value is again „0“. Of course LogView has to be started and as Device Metamor_Solar_Flash has to be selected.

Hint The prepared Logview-file Metamor_Solar_Flash works only with two values, Battery-voltage and Solar Current and Parameter 44 has to be set to "2". Otherwise the File Metamor_Solar_Flash_e at Logview has to be modified. This can be done by the OpenFormatEditor at

"C:\Program Files\LogView 2\OpenFormat\OpenFormatEditor.exe" erfolgen (also in the Programm-Group).

76: Country-Code

For SMS sending you need the correct Telephone-country-Code of your country in here. For example for Germany you have to enter 49 in here.

76: bistable Relay

It is possible to use bistable Relay (Relay that use only power when switched, that means it reduces the Power-Consumption a lot).

Just write the number of the relay which is shipped a bistable Relay (this value is preset!)

For example 234 means Relay 2 and 3 and 4 is bistable

78: Phase Loop Control

By this Parameter you can activate the Phase-Loop-Control-Function. With that you can realize an Analogue Controller with a Phase-Loop-Control for 110V/220V Outputs.

Setting of the Parameter is done by the Universal-Modul Type 50-59.

79: Message if the Battery is full

You can generate a Alarm if the battery is full. This can be usefull if you have the the Option of several Battery-Banks.

80-83: Output X switches Output Y

Here you can activate another Output activated by one Output. With that you can increase the Power for the Output by using several Relay or if one Output is not enough for the function.

You have to Input the Data like this. First the Source-Output, then the Target-Output with a leading "0" if the Output-number is < 10 for example 06 for Output 6

Example: 1406 means Output 14 switches at the same time Output 6

411 means Output 4 switches at the same time Output 11

Note: Not for all Outputs the Hardware is available. But they can be used as virtual Output for other functions in the Universal-Module.

[See Attachment for the Number of the Output](#)

96: Number of radio switch

It is possible to switch on Devices by a radio-switch (12V / 24V / 220V). Here the number of radio switch can be setup.Select Output 31.38.

Note: By using 8 switches some functions can then no longer be used.

Menu 9: Manual Mode

In this Submenu you can see which output is on (■) and which is off (.); In this case the automatic is still active You can also see what the outputs are used

Output 1:

1= L1: Load 1 Output (Power-Mosfet-Transistor)
2-7= R2-R7: Relay 2 – Relay 7 (12V/24V/110V/220V)
8=Be Beeper on/off

If you press now key 1 till 8 in this Sub-Menu then you can switch all Output manually. In this case the automatic is switched off and manual mode is active. That means that no output is switched on automatically any more.

Output Group 2:

1=PW=Solar
2=Ni=NiCd
3=L2=Load 2
4=L3=Load 3
5=L4=Load4
6=L5=Load 5
7=L6=Load 6
8=L7=Load 7

(not all Units have Load 3-5; Load 6+7 for future extension)

Analogue 1:

1:Sensor_batt = Battery voltage
2:U_ausg = Output voltage
3:Sensor_1 = Moving-Detector
4:Sensor_2 = Generator is running feedback
5:Sensor_3 = Temperature Solarpanels
6:Sensor_temp=Temperature-Kompensation Ambient Temperature
7:Reserve
8:Wahlschalter=Program-Selector

Analogue 2:

9=Analog_9 = Battery-Bank 2
10=Analog_10 = Battery-Bank 2
11=Analog_11 = Current external Load
12= I_Load 2 = Current Load Block 2

13=I_Load 1 = Current Load Block 1
14=I_Solar = Current Solar
15=U_NiCd = NiCd Voltage

Inputs:

1:Input_0 = Base Position Rotate
2:Input_1 = Start Motor Manual / Final Position Rotate horizontal
3:Input_2 = Stop Motor Manual / Base Position Rotation vertical
4:Input_3 = Stop Motor Manual / Final Position Rotation vertical
5:Input_4 = Theft-Alarm 1
6:Input_5 = Theft-Alarm 2
7:Input_6 = Theft-Alarm 3
8:Input_7 = Theft-Alarm 4

Overview Functions by the PC-Software MP_Remote

- Select the according serial COM-Port. If you use a USB-Adapter the according COM-Port has to be selected.
- Select the according Software and you have access to all documents and Plans by the Menu „Software and „Doku“.
- Monitoring and fully control of the Metamorphosis (changing of all Parameter etc). This can be realized also by modem and Mobile-Phone. You can press the keys with the mouse or with the key Alt + Number.
- Loading of the stored Measurement-Values in a Text-File pressing the key „Load Data to PC“
- Open this file with Measurement-values by the Menu “Data, View Uploaded Data”
- Loading of a new Program; Start the „Bootloader“-Software from the Menu. In there you have to select the serial COM-Port and the according Program.
- If you have a Modem connected then you can dial with „Telephone“ the according number. In this Menu you can also disconnect the connection.
- The connection can be established by Mobile phone as well.
- Activation of the Sending of Data to Logview or any other Program by the Menu Data, „Data, Send Data for Logging (LogView)“. After activation Stop the MP_Remote and Start Logview. And select as Device “Metamorphose_Solar_e”. Refer to Document “Logview-Info” for more Information.
- All Parameters which are Setup in Menu 8 can be uploaded to a Text-File by the Menu “Data, Get Parameters”.
- They can be modified in the Text-File. Select the File by Menu Data, change Parameters. Then they can be loaded again to the Metamorphosis by Menu “Data, Send Parameter”. By that you have more Information on each Parameter and a backup of your Data is possible.
- All Parameters which are Setup in the Universal-Module can be uploaded to a Text-File by the Menu “Data, Get Data Universal-Module”.
- They can be modified in the Text-File. Select the File by Menu Data, change Parameters. Then they can be loaded again to the Metamorphosis by Menu “Data, Send Data Universal-Module”. By that you have more Information on each Parameter and a backup of your Data is also possible.
- By the Button „Display all Data“ you can enlarge the Display and more Data are shown. But for the Input of Data it is better to press the Button “Stop Display for Input of Data” temporarily.
- By the key “Simulation” a Simulation-Value for testing can be Setup
- In Menu “Data, Edit Input/Output-List” the Name of all Inputs and Outputs can be Setup for Documentation.

Installation of the PC-Software MP_Remote

This Software is for Loading of the measured values on the PC and fully Operating the Metamorphosis with the PC

Installation

On the CD you find the Software „MP_Remote“. How to install?

- For this call Setup_MP_Remote_eng.bat on the CD.
If you have Vista register the OCX in this way:
Call Programs, Accessoires, command prompt; Then right click „run as Administrator“; and „continue“;

Then navigate to the folder c:\Metamor by
 C:
 Cd Metamor
 Then enter "register" and „exit“

- Now connect the metamorphosis with the cable you get to the serial interface of the PC
- Then call the program C:\Metamor\MP_Remote.exe
- After the start selected the COM-Port. Begin with COM1 and if it doesn't go select COM2

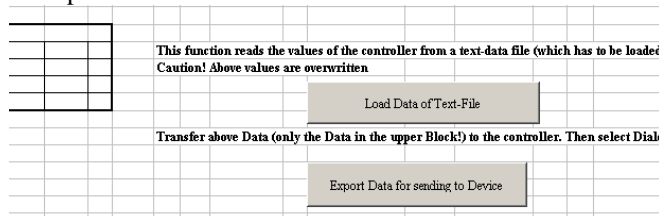
Loading of the Logged Data to the PC

- Now press the button "Upload"; the data will now be loaded and "End" will be displayed when finished.
- Now you can look at the data with the function "Data" and "View uploaded data" you can write comments, print it and import them in Microsoft Word or Excel for example (import to Excel: File, open, Typ "all files", then go to folder C:\Meta\data.txt, then Data is separated by Blank)

Loading the Data of the universal modules to the Metamorphosis

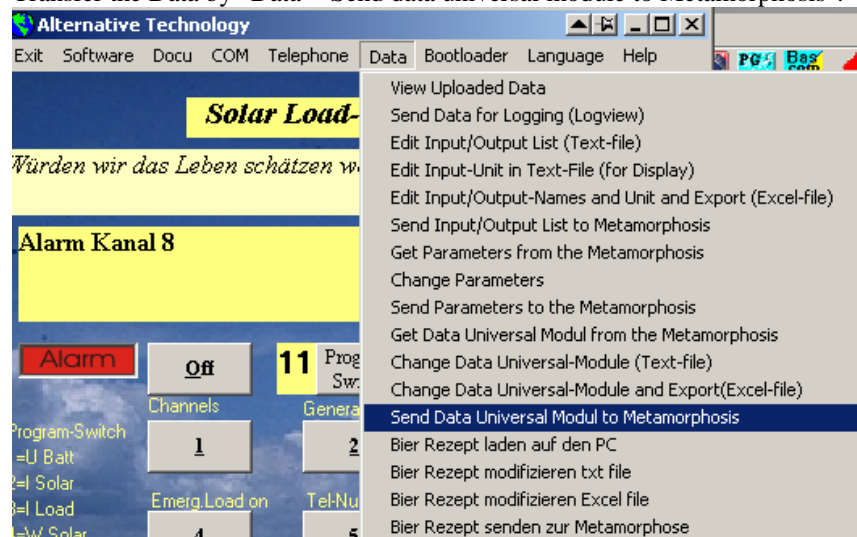
The data from the Excel spreadsheet of universal modules can be transmitted to the controller. A text file is generated first which is loaded to the Metamorphosis by the MP_remote-program.

1. Exporting from Excel: Down at the table there is a button "Export Data to send". Push this button and the data are exported to a text file.



2. Connect the metamorphosis by the cable to the PC and switch it on. Transfer the Data to the metamorphosis by calling C:\Metamor\MP_Remote.EXE.

Selecting language and at "Software" is the right software "charge controller"
 Set the COM interface properly
 Transfer the Data by "Data" "Send data universal module to Metamorphosis".



Wait until the process is completed by display on the LCD display.

Conversely, the data can also be uploaded from the controller to the PC (a text file). This is done by Menu "Data", "Get Data Universal-Module from the Metamorphosis". This text file can then be imported to Excel by the button below "load data of text file".

You can specify text for the inputs, outputs and messages. These are defined in Excel first Sheet "input/Output" There you can set the names for the inputs and outputs in the first sheet where output 17-24 can be a free alarm text for SMS.

This can be loaded into the device to display the alarm and information.

Export these texts with the button "Export to text file for sending" in Excel.
Then transfer it by the MP_Remote Program, Data, "Sending input / output list to Metamorphosis,". Wait until Metamorphosis shows "ok".

Monitor Values with LogView

Logview is a Software (Freeware) to Monitor and evaluate Process-Data

Short Overview about the Features of Logview

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

Installation

For to let the Metamorphose send Data to Logview start the MP_Remote-Software and select Menu „Data, Send Data for Logging“.
Then finish the MP_Remote-Software and Start LogView. Now all relevant Data are send cyclic.

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

After the Installation of the Software copy from the CD \LogView\OpenFormat\ all files to
C:\Documents and Settings\your User-Name\Application Data\LogView\Geraete\OpenFormat\

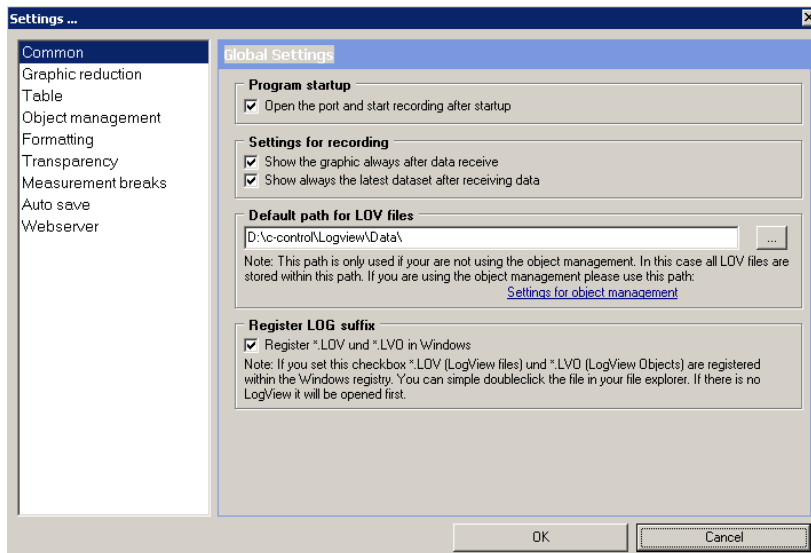
Start LogView

Select Device at Menu „Device, choose Device and Port“ the according Device:

Solar Charge Controller Cycle Data: Metamorphose_Solar_e
Solar Charge Controller Flash Data: Metamor_Solar_Flash_e
Irrigation-System Cycle Data: Metamor_Irrigate
Irrigation-System Flash Data: Metamor_Irrigate_flash

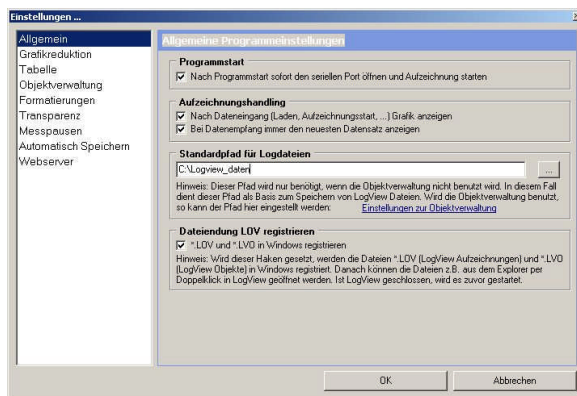
Select according serial COM-Port as well

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

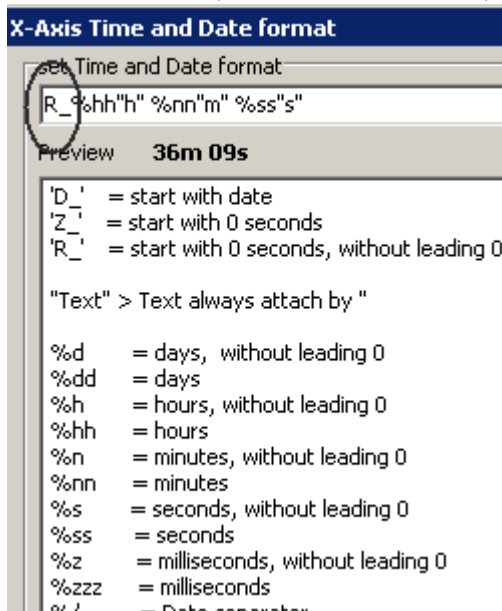
Register Log suffix should be checked that you can start Logview by direct clicking the *.lov file.



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.



Sending of logged Data to LogView

Logged Data stored in the Flash-Memory from Analog-Inputs can be uploaded to Logview. Switch in Menu 8, Parameter 75 to „1“ to upload. After Transfer of all data this value is again „0“. Of course LogView has to be started and as Device Metamor_Solar_Flash has to be selected.

Hint: The prepared Logview-file Metamor_Solar_Flash works only with two values, Battery-voltage and Solar Current and Parameter 44 has to be set to “2”. Otherwise the File Metamor_Solar_Flash_e at Logview has to be modified. This can be done by the OpenFormatEditor at "C:\Program Files\LogView 2\OpenFormat\OpenFormatEditor.exe" erfolgen (also in the Programm-Group).

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

Using the GSM modem

This function is currently only possible by a Siemens mobile phone or a Siemens GSM modem (f.e. TC35).

Inserted the SIM card in the slot at the side. With a sharp object it can be released. You must use a data-compatible SIM card.

Link the modem to the power plug, which is next to the canon-data-plug.

Connect the modem with the data cable and turn on the metamorphosis.

The green LED on the GSM will blink for a while and then goes to steady light when it is linked in to the network.

Is that not the case, may be a PIN has to be input. This can be done in menu 8 in parameters 14. Restart the metamorphosis with the GSM connected.

To test the Modem go to Menu 8 parameter 58 and select "Send SMS".

In the menu 5 for the phone numbers, you can test the GSM-Modem now by input a Phone-Number.

Then navigate with the "#" key to "Test" press "1". A SMS will be sent to the specified phone number.

Should a SMS also be received by the GSM modem, change in Menu 8, Parameter 22.

To check send a SMS with text “Meta31” to the metamorphosis. Thus, the output 3 should be switched on.

To switch off send a text message with “Meta30” to the metamorphosis. Thus, the output 3 is switched off and can be switched on by the auto again.

If this relay should be set to automatic again, send “Meta39” to the Metamorphosis.

If all relays should be switched back to automatic send “Meta00”.

It takes about 1 minute until the SMS is evaluated

If in menu 9 something is switched in manual the control via SMS is off.

If a Siemens mobile phone should be used with a data cable, please note the following:

The following settings must be made with the mobile phone.

In "Settings" you find "Fax Data Mode".

Activate receive FAX / data and send FAX / Data.

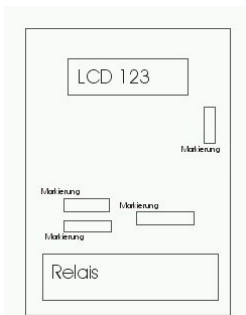
Also switch "off" functions IrDA and "headset".

More details in Menu 8 parameters 22

Hints and Tricks

- If there are wired symbols on the LCD-Display you can reset the Display (without need to Restart the Unit) by pressing the key „0“ twice.
- At Menu 8, Parameter 15 “Additional Device on” you can select that another device is switched on, if the Battery is full. You can define the voltage for to get the device switched on. But there is a delay for it.
- There are only two Current-Measuring-Units integrated. Therefore Current Load 1= Load Channel 1+2; Current Load 2= Load Channel 3-5;
- If the Battery-Type is changed, all standard-Settings will be loaded for this Type
- In order to avoid frequent switch on/off there is a delay-time for switch off and back the Load after battery was low

- Wait for Data-Input Menu 8 approx. 20 sec after switch on, because after this time the presetting of Data is finished.
- Only the door-Alarm generates a Telephone-Notification. If you want more you have to change this in the Source-Code (at Anrufen_alarm:) and download it.
- If you use a Inverter, better connect it directly to the Batteries instead of going through the Inverter. The Inverter has a automatic for switch of when the batteries are empty. And the Start-up Current of the Inverter may exceed the limit Current of the Charge-Controller.
- If you press the key "*" during Switch on of the Controller you enter the **Simulation-Mode**. With the voltage-regulator at the right side next to the Program-Switch you can simulate now the Battery-Voltage and Current for Testing and Demonstration
- Next to the PC-Adapter on the Unit you find a switch for to reduce Power-Demand. Switch it on only if you use serial PC-Data Transfer (for the Software "MP_Remote" or any Terminal-Program) or if you use the Voltage-Regulator 3-12V for Appliances or for Simulation (Adjustable Resistor at the right side)
- In the Program at Function Menu 7 you can display easily all desired Values
- On the CD you find the Program "Ultraedit" (/Tools). With this you can easy Edit the Program
- The switching Points for the Relays are delayed (about one minute). Keep that in mind if you are testing it!
- If you have a very small log-Time (for example 1 sec in Menu 3), then there could be a Delay if you press the keyboard, so press it several times.
- If you are using only Relay for Charging from the Sun, you have to Input the Time (Menu 7) in order to have it switched off at night.
- In Menu 7 you can view other interesting Data by selecting the Value with the Program-Switch
- In Menu 9 / Inputs you have some information about the Status of charging
- If you make your own Program-changes, keep in mind not to exceed the Program more than 97%! Otherwise you would overwrite the Boot-Loader and the CPU can not be reloaded again.
- If you removed the cable inside, there is a mark at the cable and at the board to put it back in the right way. See Picture!



If you are using the Compiler BASCOM frequently, you have to buy a License! The Price is about 80 Euro and you get it at www.elektronikladen.de.

Loading of NiCd/NimH-Accumulators

Put the Accumulator (NiCd or NimH) in the according compartment (look for "+" and "-", the spring is always Minus!), and they will be charged automatic according to Voltage in Parameter 23, Menu 8. If you have two NimH-Batteries you enter 2,4V; For three Batteries 3,6V and for four Batteries 4,8V etc. If the battery is full a message pops up. To have a better Time-Out for loading, you should enter the mAh-Value of one battery in Parameter 23, Menu 8

If you want to know more Details about the charging of NiCd/NimH-Accumulators:

- The NiCd/NimH –Measurement is processed all minute
- First check whether there is a battery in the slot
- If there is a new Battery inserted or the voltage drops below 1,3 V per cell, the Max-time loading (depending from capacity) is started
- Now detect **Delta U/Delta T**, that means check the change of the voltage in a dedicated Time-window.
- If there is no change Start a delay-time (Preset in the header at Parameter Sp_delay_delta_u: in minutes * 20: 6 = 120 min).
- If this time is elapsed, then Start the Trickle Loading (90 min; Preset in the header at Parameter Sp_trickle_loading = 90).
- After this time the loading is finished.
- Now detect the **Nicd max.voltage**, that means if one cell has more than 1,45 V (you find this value in the header at U_max_nicd).
- If the voltage is above this Voltage then Start a delay-time (60 min; Preset in the header at Parameter Sp_u_max_delay: in minutes).
- If this time is elapsed, then Start the Trickle Loading U max (Preset in the header at Parameter

- Sp_time_trickle_load_umax = 90)
- After this time the loading is finished.
- If the voltage is more than **U max max** (1,5V per cell; Preset in the header at Parameter U_max_max_nicd) then Stop loading
- If the **Max-time loading** is elapsed (about 14 hrs, but depending from the Capacity; Preset at Max_time_loading), the loading is also finished.

Loading of new Software

To load new Software into the Metamorphosis you have to Start the Program „**BootLoader.exe**“ (on the CD in the \Boot-Loader-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 Metamorphose off and on.
- ➔ If still no Download-Window is popping up, something with the cable is wrong or with the Metamorphose
- If you want to make Programm-changes you must install first the Software BASCOM from the CD (you get it with the Metamorphosis). To install it call \BASCOM-AVR\Setup.exe. Install to the folder C:\BASCOM-AVR (**and not to C:\Programme\MCS Electronics\BASCOM-AVR as recommended**)
- To make your own programs, install \Bascom_new_Version\update.bat as well to get the latest Version of BASCOM
- After you downloaded the Program-Files from the Internet you have to unpack the files first by double-click on the .exe file. If you get a .zip-file you have to use Win-zip or you can install the Windows-Commander from the CD to unpack it.
- Now connect the cable (you get with the Metamorphosis) to the parallel Interface of the PC (big plug) and at the appliance (the plug with two cables coming out) and switch it on.
- Start the Software using the Explorer and Double-Click on C:\BASCOM-AVR\Bascavr.exe. But you can also go to the Start-Button and Programs and \ MCS Electronics\BASCOM-AVR to Start it.
- Select „Options“, „Programmer“; Select MCS-Bootloader
- Select "File" and "Open" and open the file with the extension .bas (from Floppy or where you have it after downloading and unpacking it from Internet).
- Then select in the Menu "Program", "Send to Chip" or simply press key "F4".
- Then Press button "Chip" and "Autoprogram". The program will be loaded now
- After everything is downloaded, switch off and on again the Metamorphosis. Now the new Software should run
- For additional Testing you can use the internal Terminal-Program (Ctrl + T); Make these adjustments: Go to Options, Communication and set the Baudrate to 19200 and also at Compiler, Chip, Communication, Baudrate

Problems?

- ✓ The cable is connected in the right way? The Metamorphosis is switched on?
- ✓ For XP install the Software from the CD \Programmer_XP\ParPort.reg by just clicking on this file
- ✓ The PC must be set top ECP/EPP mode in the BIOS (pops up after start and key F2 or Del or ...?)
- ✓ Optional you can use for Windows 98 from the CD \programmer_win98\ Charge_Controller.BAT to download the Software

Error-Messages

Battery low: Battery voltage is low and Outputs will be switched off soon.

Battery empty: Battery is empty and Outputs are switched off.

Battery full: Battery is fully charged

Temp Alarm: Charging is switched off due to high Temperature

Theft Alarm: One Alarm-Input was giving a Alarm or the Cable to the Panels has been switched off

Load I max: Overcurrent Load. To many devices connected

Solar I max: Overcurrent Solar. To many panels connected

Weak Battery: The battery-voltage changed very fast during charging. In most cases this is a indication for a old battery.

Appendix: ***General Features***

- Up to 30 A Solar Charging-current using Power-MOSFET Technology with On-Resistance of only 0,008 Ohms
- Temperature-Compensated overcharge Protection for the Battery. Floating-charge with fast Dynamic Pulsing (PWM-charging), Boost-charging (depending from the discharging level or at least once a month loading to the gassing-voltage for a specific time)
- Five different Load-Outputs (up to 16A, 12/24/110/220V) with different voltage-levels for independent shut-down of the load in case of a empty Battery. All Set-Points for the Voltage can be programmed freely.
- Dynamic Switch off Voltage-Levels on all channels according to the history before. This gives a more accurate Battery-Empty detection.
- Five independent Timer Outputs (up to 16A, 12/24/110/220V) in order to let the User use Solar-Energy only at the evening etc. Or if the fridge should run only at daytime.
- Extensive Information about the System: Battery-Voltage, Solar-Current, Load-Current, Solar-Power in W, Solar-Yield in Ah and Ah/day, Load Output in Ah and Ah/day, Temperature, Time and State of Charge (SOC). Voltage and Current are displayed graphically as a bar.
- Calculation of Current, Ah and KWh for the Load in two channels. This can be useful if you want to have a Payment-System for the Energy.
- More than 4500 (2500 for the M128) Measurement-values are stored in the Metamorphosis (Solar-Data for more than 30 days!). They can be uploaded to a PC or Notebook (the necessary cable and Software will be delivered with the Metamorphosis). Programmable Scan-Time (each 10 seconds, minute, 2 minutes etc). On the other side you can have remote access to this data using a Modem or a GSM-Mobil-Phone or even Internet
- Optional with a MMC or SD-Memory-Card 16 Mio Measurement-Values can be stored (16 bit values) und uploaded by the Metamorphosis. You can select which Measurement-Values should be scanned (up to 11)
- Extensive Software for Realization of a **Solar Hybrid-System** (with a Generator-Set). Automatic and Manual Start / Stop of a generator-set depending from the Battery-Status, three Start-Trials, Alarm-Message, three independent Maintenance-Timer with Alarm, Timer Start Generator (special time or every second day at ...)
- Optional Relay-Output for to Charge Battery with an external Power-Supply. This is very useful for example High Current Loading of the Batteries with a Generator
- One Emergency-switch to have Light / Power in any case.
- Self-healing automatic switch-back Fuses for the Load Outputs.
- Automatic Temperature-correction of all voltages
- Available in 12V or 24 V Versions, automatic voltage detection.
- For Acid-Batteries and Gel Batteries
- Radio-Sensors can be connected and logged (Optional). There are a number of Sensors (from ELV) available: Temperature, Wind, Humidity and Rain. In this way the Charge-Controller can be extended to a Weather-Station.
- **Multistage theft protection.** This is a very serious point for Solar-Systems

- There can be a alarm if the door of the switch cabinet is opened (if you install a door-switch)
 - With a external 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 to the Panels. Of course the voltage can not hurt anybody.
 - Up to four additional Alarm-Inputs can be programmed
 - The Alarm can generate a loud Alarm-Signal if something is connected
- Extensive Message-System for all Alarms with Text on the LCD-Display and remote.
 - Optional you can have a telephone-call if there is an Alarm (somebody opened the door at the rack etc). A GSM-Mobile-Phone or a Modem (For example Siemens S25/S35/S45 etc) can be connected directly to the Load-Controller.
 - An Alarm-SMS can be activated as well, if you have a Mobile-Phone connected. Up to three telephone-numbers can be selected.
 - You can switch all Outputs by a SMS, if a Mobile-Phone is connected.
 - Up to **three different Battery-Banks** can be charged. In this way the Charge-Controller can be used as a Battery-charging-Station. **If you use this Function, the max. Current for all Battery-Banks is 16A!** You could increase this value if you use an external Relay.
 - Another SMS can be activated by a switch. So a kind of emergency-telephone can be realized (at Highways to call for Help etc)
 - Energy-Optimized tracking of the solar cells to the sun in two Axis (up to 25 % increase in the Solar-yield)
 - Programmable Timer for switching a lamp or any other Device.
 - Three Lamps for Auto-switch-off. The Lamps are switched on by a Switch for a dedicated Time. For example in a Toilette etc.
 - Connection of a movement detector for to have a Lamp on for a preset time
 - Switching on a device (for example a water-pump) when the battery is full for not to waste Solar-Energy
 - Free Transfer of Functions to Outputs. In this way you can easy select between Relay-Output (12V/24V/110V/220V) or Power-MOSFET Output (only 12V and 24V), according to your Plant configuration. And if an Output is broken, just select by Software another free Output and the System works again.
 - Optional: Simple System for Cooling of the Solar Cells (particularly in concentrated versions). As it is generally known the output of the Solar-cells decreases with higher temperatures. On the other side the Surface of the Solar-cells will be cleaned for better performance in dusty ambient.
 - **Extensive Safety Precautions:** Over-temperature protection, short-circuit Protection, Input over-voltage Protection, Battery Reverse connection protection.
 - With numeric keyboard and LCD display for to Display of all Information and settings of all relevant Parameters.
 - With the keyboard you have access to all necessary data and settings. You can change the parameters like Switching-points for the voltages, Pre-Alarm, Hysteresis, Number of channels, Gel or Lead-Acid-Battery, Language etc. All Values can be reset to Preset Values.
 - Optional: One regulated Outputs-voltage with 3V – 12V / 1 Amperes with over-temperature and short-circuit protection for to connect small appliances like CD-Player, Walkman etc.
 - One fixed output-voltage of 5 V and optional one more fixed User-voltage (3-22V).
 - Using Solar people often use torches or battery-radios as well, which need new batteries frequently.

Optional integrated Loading-Unit for rechargeable NiCd or NimH-cells (for torches for example). 2/4/6 batteries can be charged at one time.

- Charging of 1,5V alkaline rechargeable batteries. Two or six batteries at one time
- Optionally the loading of the lead-acid-batteries can be realized with a 220 V Transformer as well (for Hybrid-Systems for example)
- Very easy upload of a new Program by cable. This could be realized also remote by a Modem, Mobile phone or by Network (Internet).
- Data communication and full operation of all functions with a modem, Mobile-Phone or by Network (Internet). You can remote access to all parameters and measurement values and you can also switch on/off a connected device (pump etc). A Software for to manage this will be provided.
- For each Function (Solar charging, Solar Tracking, you can define which Output you want to use, which Transistor-Output or which Relay. In this way you are very flexible with the different functions and you can repair by Software the Device if one Output is defective. And you can even define whether the Output should work inverse. That means for example the Relay for solar charging is activated, when the battery is full.
- You can activate a Simulation-Mode for testing all functions without having Solar-panels etc.
- This is the Standard-Functions. But additional functions can be realized easily. You get a cable for easily downloading of new Software. There is a Patch-Field on the Board for additional Hardware extensions.
- It is an **Open System** which can be assembled according to your specific demand. You can select of a range of the ELV Radio-Sensors (Temperature, Humidity, Wind, Rain). You have many Cable-Sensors for Temperature, Brightness, Alarm-Switches, Motion-Detectors, Counter etc). There is a Interface to the wonderful Software LogView (Freeware) for to display Process-Data. You get the Open Source-Software MP_Remote for to Monitor and Control the Unit.
- Make your own Programs! You can use it also for your own Applications as a Micro-Controller-Development-System. The Basic-Compiler is free for small Programs. There is an Open-Source Software and Template for that for free. Look at www.alternative-technology.de/Mikrocontroller System/Mikrocontroller System.html

Note: Take care! Not in all devices all Functions are available. Check your Order!

Specification / Technical Data (maximal Configuration)

Specifications solar charge controller	
System-Voltage (automatic switch over)	12 V / 24 V (48 V with two Solar charge Controller)
Battery-types	Lead or Lead-gel, AGM, open or closed (maintenance free)
Max. input voltage	35 V

Max. solar-current	30 A
Max. Load current	15 A
Max. relay	6
Max current relay-Output	10 A with 12V / 24V / 220 V
Automatic short circuit-protection of the Relay Output	12V/24V yes, 220V no (must be applied externally)
Max. number analogue Inputs	15 (5 internally used)
free selection of the input-Typs	Voltage; Current, NTC, PTC, Pt1000, 0-20mA, 4-20mA
Compatible with ELV-Radio-Sensors	Wnd, Temperature, Humidity, Rain
Connection impulse-valves, requires.Energy just for switching	optional
Max. number digital Potential-free Inputs	8
Counter-Input	1
Power-consumption of the Unit	15 mA
max.ambient temperature	-25 °C... +50 °C
max. cable connection (fine - / single-wire) Solar	16 mm ²
max. cable connection (fine - / single-wire) Relay	2.5 mm ²
Protection-Class	IP 32
Dimension L x B x H in the standard-casing	200 x 190 x 78 mm
Dimension L x B x H big Case	290 x 260 x 115 mm
LCD-Display	yes, 2*16 signs
small LCD-Display	74 x 35 mm
big LCD-Display (fits only in the big Case)	99 x 24 mm
Keypad	yes, 12 buttons
Program-selector	yes, 12 positions
Max. number serial interfaces	2

Download of new software by the PC	yes
optional adjustable Voltage-Output with 3V. 12V/24V, 1A	yes
optional charge of NiCD and NiMH-Accus (max 500 mA)	yes, adjustable Voltage, Capacity
charge of the batteries by a 220V/12V-Power supply	yes
Connection Energy-counters	yes
Load end Voltage	13,7 V (27,4 V), adjustable
Boost-Voltage	14,4 V (28,8 V) adjustable
Equilaziation-charge	adjustable
Deep Discharge	yes, Voltage for each canal is adjustable
SOC-Control (State-of-charge)	yes, Voltage or SOC-Mode
dynamic undervoltage-Load shedding	yes, de-energized
Display of Load current	3-Channel, 2 * internally, 1 * external
Over-Temperature-Protection	yes
Reverse-Connection-Protection	yes
Automatic short circuit-protection of the Load-Output	yes
by voltage protection Solar-Input	yes
Over-voltage-protection if no battery is connected	yes
Protection for re-reverse connection of the modules	yes
Generator-function (start / stop, alarm etc)	yes
connect Wind-generator	yes, max 30 A

Wind-generator storm-protection.	yes
Management of a Solar Thermal System (Difference-Temp etc.)	yes
Night-light-function	yes, several Channels
to save Energie: Power-management-Function (Auto Device on/off etc)	4 Channels, more possible
Theft-Protection, also by telephon	yes, several Channels
cooling solar-cells	yes
Auto cleaning solar-cells	yes
Tracking Solar-Cells to the sun	yes, 2 Axis
Additional Device on at battery full	yes
Run dry Protection pump	yes
free programming of Interlocks	yes
Manual control by all Output	yes
Digital simulation of all analogue-Inputs	yes
Max. number of stored measured values	4000 16-bit-values
Optional data logging on MMC / SD-card	yes, with it 16 million measured values
Interface to the free excellent Logging-Software Logview	yes
Remote control by a Windows PC (using the freeware Dialer)	yes, all functions
Remote control by modem, mobile-telephon, GSM-Modem	yes
with that SMS-handling (Alarm and switches Output)	yes
optional connection of a cable-telephone	yes, 2 phone numbers
optional network / internet-connection	yes
Max. number universal-Modules for addition-functions	20

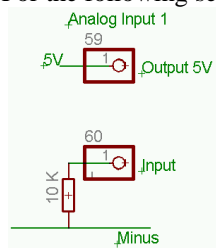
optional PI controller-function by 12V/24V, 220V analogue-Output	possible
Output auxiliary-Voltage 5V, 0,5A	yes
optional adjustable Voltage-Output with 3V. 12V/24V, 1A	yes
Switching of an external high-current-charger	yes
short high-current-impulses for the reducing of Sulphating	yes
Max. number of independent battery-Banks	3
several charger-controller parallel and synchronous	yes
free User-Alarm-text on LCD and SMS	yes
emergency telephone-function: SMS or telephone-call by Push-button	yes
all important parameters can be changed	yes, more than 80 parameters
Operation-languages (at present)	German / English

Hardware:

Analog Inputs

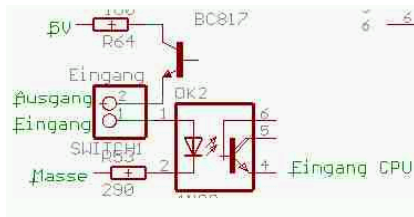
The input is internally connected with a 10K resistor to ground. With a little effort it could also be changed internally. But it can also be adjusted by an external shunt resistor to ground. An external resistor of 10K gives for example a total resistance of 5K ($1/R = 1/R1 + 1/R2$). For accurate measurement, it is good if this resistance is about the same as range as the sensor resistance.

For the following sensors, there is a table: 10K NTC, Pt1000, PTC.



Digital inputs

Isolated inputs are used. A 5V signal is set for a short time at Terminal 47, 50, 53, 56. 24V or another voltage can also be applied but you need a series resistor. At 24 V, the series resistor is about 4.7 K. The wiring for 24V is: 24V to external Contact. Output of Contact to Input 48, 49, 51, 53



Outputs

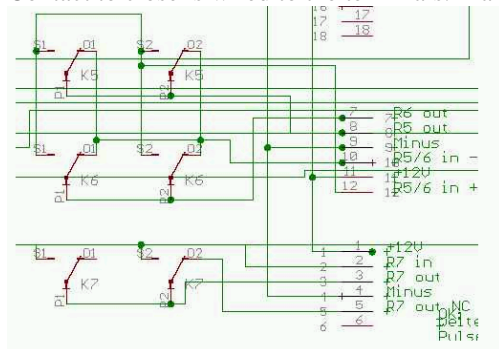
Output 1 = Transistor Output

Output 2-7 = 10 A relay, rest is transistor

Output 15 is a 1 A relay internally wired

Relay 2 +3 and 4 +5 are each interconnected to be able to make a motor go left and right (solar Tracking f.e.).

This also means relay 2 +3 have the same Input voltage and relays 4 +5 as well. In each case Contact to open and Contact to close is wired to the terminals. Max 10 A / 220 V for the Relay.



Take care!

Automatic short circuit-protection of the Load-Output with 12V and 24 V (Relay and Transistor)

For 220V short circuit-protection the must be applied externally

Serial Communication

The Baud-rate is 19200 Bd with 8 characters, no Parity, 1 Stop bit. (8, n, 1)

Overview Parameters and Presetting-Values

(all values without comma)

Nr

1 Switch off Load 1	: 137
2 Switch off Load 2	: 2930
3 Switch off Load 3	: 34
4 Voltage for Pre-warning:	762
5 Hysteresis Switch back	: 138
6 Voltage for Battery full	: 144
7 Cycle Loading Gel-Battery	: 147
8 Cycle Loading Lead-Acid-Battery	: 150
9 Maximum Voltage	: 0
10 Language	: 1
11 Battery-Type Gel or not	: 0
12 Channels Relay Solar	: 2
13 Channels Load	: 0
15 Hyst. Additional Device on (if Battery full)	: 0
16 Umax->add.Device on for x min/hr(0=off)	: 0
20 Generator	: 0
21 PWM-charging	: 1
22 Receive SMS	: 0
23 Faktor for Simu;	: 120
24 Cooling Panel:	0
25 Cooling on/60:	20

26 Switch off Load 4 : 0
 27 Switch off Load 5 : 0
 28 NiCd/NimH-Charging : 0
 29 NiCd/NimH Capacity : 110
 30 Gen.SOC : 0
 31 Start Generator at... : 10
 32 Load /SOC : 563
 33 Correction SOC : 1
 34 Solar I Corr : 0
 35 Temp-Corr U Batt : 120
 36 Rotate Y-Axis: 10
 37 Rotate Slip : 0
 38 Time go back : 1
 39 Correction U.Batt : 0
 40: 0
 41 Hardware-Version : 2
 42 Solar charge on/off by Time : 0
 43 with SD-Card (0/1) : 1
 44 Scan Analogue Inputs (0-) : 0
 45 SD-Chip Block-Nr : 0
 46 Dynamic Switch off Voltage-Level : 0
 47 Analogue Input correction +/- : 90
 48 Analogue Input correction Factor * : 0
 49 Number of Battery-Banks (0=off) : 0
 50 Delay Battery Bank Full (in min) : 100
 51 Umin->Switch to 1.Batt.Bank (0=off) : 100
 52 Select Batt-Bank manual : 0
 ..
 60 Output Battery-Bank 1 : 0
 61 Output Battery-Bank 2 : 10
 62 Output Battery-Bank 3 : 0
 63 Output Light Auto off 1 : 0
 64 Output Light Auto off 2 : 0
 65 Output Light Auto off 3 : 0
 66 Output Light Auto off 4 : 0
 67 Bank 1=Charge: 0
 Bank 2=Discharge : 0
 68 High Current Pulses on/off : 0
 69 Network off / Master / Slave (Connect several Units by a Bus) : 0
 70 Standard-Settings : 0
 71 Correction KWh : 0
 72 Alarm at Start Generator (0/1) : 0

 76 Country-Code : 94

Digital Outputs

1 = MOSFET-Output: Load 1 (external Terminal); Max. 10A or internal at Terminal 35 (Plus) and 36 (Minus); Minus is the switched Output

2 = Relay-Output 2: Terminal 31 + 30 (Normally open) or 31 + 32 (Normally closed); max. 16A, 220 V

3 = Relay-Output 3: Terminal 22 + 24 (Normally open) or 26 + 24 (Normally closed)

4 = Relay-Output 4: Terminal 22 + 23 (Normally open) or 26 + 23 (Normally closed)
 Relay 3 + 4 could not be used with different voltages. Voltage Input has to be connected to Terminal 22 and/or Terminal 26.

5 = Relay-Output 5: Terminal 12 + 8 (Normally open) or 10 + 8 (Normally closed)

6 = Relay-Output 6: Terminal 12 + 7 (Normally open) or 10 + 7 (Normally closed)
 Relay 3 + 4 could not be used with different voltages.

Voltage Input has to be connected to Terminal 12 and/or Terminal 10.

7 = Relay-Output 7: Terminal 3 + 2 (Normally open) or 3 + 5 (Normally closed)

8 = Beeper (intern); not wired for Solar charge-Controller

9 = MOSFET-Output: Load 2 (external Terminal); max. 10A

10 = MOSFET-Output: Load 3 (external Terminal); max. 10A

11 = MOSFET-Output: Load 4 (external Terminal); max. 10A

12 = MOSFET-Output: Load 5 (external Terminal); max. 10A

13 = MOSFET-Output: Load 6 Terminal 211 (+), 212(-) (interne Terminal)

14 = MOSFET-Output: Load 7 Terminal 110 (+), 111(-) (interne Terminal)

15 = internal NiCd-Relay (1A)

16 = Telephone-Call: internal Relay

Analogue Inputs

(Reference to the Number 1-15, Resolution 10 bit)

- 1: Battery Voltage (internal)
- 2: Output-Voltage (Plus at Terminal 43, Minus at 44)
- 3: Moving Detector (Signal Plus 5V from Terminal 59, Signal at Terminal 61; optional 12V Power-Supply Plus at Terminal 41 and Minus from 42)
- 4: Generator on (Plus from Terminal 62, Signal at Terminal 63)
- 5: Temperature Solar-Panel (Sensor at Terminal 62 and 64)
- 6: Temperature Compensation Ambient Temperature (internal; if external then Signal at Terminal 71 and 72)
- 7: internal
- 8: Program-Switch (internal)
- 9= Voltage Battery-Bank 2 (Measuring at Terminal 75)
- 10= Voltage Battery-Bank 3 (Measuring at Terminal 76)
- 11= external Load Current (Inverter). Signal at Terminal 78, Minus at Terminal 42
- 12= Load-Current 2 Output 1+2
- 13= Load-Current 1 Output 3-5
- 14= Solar- Current
- 15= Voltage NiCd / NimH

- 16 = Minimal-Value Analog-Input
- 17 = Maximal-Value Analog-Input
- 18 = Runtime-Value Output

- 21 = Counter 1 (Input 84 + 86)
- 22 = Counter 2 (Input 85 + 86)

for Universal-Module

90: on by SMS with Text Meta81; Off by SMS-Text Meta80

91: on by SMS with Text Meta91; Off by SMS-Text Meta90

Digital Inputs

(all Potential free)

- 101 = Digital-Input 1 (Terminal 47+48)
- 102 = Digital-Input 2 (Terminal 47+49)
- 103 = Digital-Input 3 (Terminal 50+51)
- 104 = Digital-Input 4 (Terminal 50+52)
- 105 = Digital-Input 5 (Terminal 53+54)

106 = Digital-Input 6 (Terminal 53+55)
107 = Digital-Input 7 (Terminal 56+57)
108 = Digital-Input 8 (Terminal 56+58)

201 = ELV Radio-Sensor 1 (by external Receiver)
202 = ELV Radio-Sensor 2 (by external Receiver)
203 = ELV Radio-Sensor 3 (by external Receiver)
204 = ELV Radio-Sensor 4 (by external Receiver)

Notes for the Electrical Wiring

see the Sheet "Terminals" and Overview for Wiring-Details

Some of the Terminals are located inside the Box, the other ones on Top. Open the two screws for access. You can fix the Unit with the two screws and the two holes on the cooling plate at the wall.

Theft-Alarm-Switch (Door-switch for example): This can be a mechanical-switch or a Reed-Relay.

Output Lamp or High-voltage Generator (Alarm): One Output of the High Voltage Generator has to be connected to ground, the other one to the Panels. The Panels have to be mounted isolated to Ground

External Alarm-Horn: Can be 12V/24V or 110V/220V

Voltage 3-12V output: max. 2A!

Charging Battery with a external Transformer: 12-15V, max. 0,5A

The Relays are not short-circuit protected. You need to install a external protection

Keep the Input-cable away from 110V, 220V or 380V cables! At least 30 cm.

Save Power!

It is absolutely comprehensible that people want to use more and more electrical appliances, for example lamps, computers, etc. yet we should learn to use such devices only when it is really necessary:

- o Turning off lights whenever possible
- o Preferring large windows so that there is no need for electrical light during the day
- o Using energy-saving lamps instead of traditional bulbs
- o No extensive lighting - punctual use
- o Shadow and good ventilation instead of air conditioners
- o Laptops instead of desktop computers
- o Turning off all electrical appliances after use, no stand-by circuit
- o Only printing of communication which is really important
- o Ironing as little as possible - no bedding, underwear etc..
- o Modern appliances use less energy than older device
- o Eliminating of the old cables which are no longer used
- o If an electrical cable is getting too warm, it is too thin (heat = energy loss), use thicker ones
- o Using of electricity-intensive device only if public energy is available or if the diesel generator is running
- o Replacement of old electric water pumps with solar pumps

Each householder should make sure that there is not consumed too much energy in his area. He should establish and enforce rules regarding the reasonable use of energy.
(from BEGACA)

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Terminal-List for the external wiring
(see extra File or Sheet)

Schematic of the external wiring
(see extra File or Sheet)

Overview Universal-Channels (Excel-Sheet)
(see extra File or Sheet)

Network-Adapter XPORT. Installation and Setup (optional)
(see extra File or Sheet)