Appendix for

Kaco inverters

WebdynSun

The monitoring gateway for your solar installation

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1 Connecting the gateway to Kaco inverters via the RS485(A) communications bus

This chapter describes the method for connecting the WebdynSun to the RS485 communications bus so that it can communicate with the inverters.
The gateway may be connected at the end of the RS485 communications bus or in the middle of the bus.
The gateway can handle up to 32 Kaco inverters.

- All wiring must be carried out only by a specialised qualified electrician.
- Prior to installation, all equipment connected to the corresponding communications bus must be disconnected on both sides (DC and AC).
- Respect all safety recommendations appearing in inverter documentation.

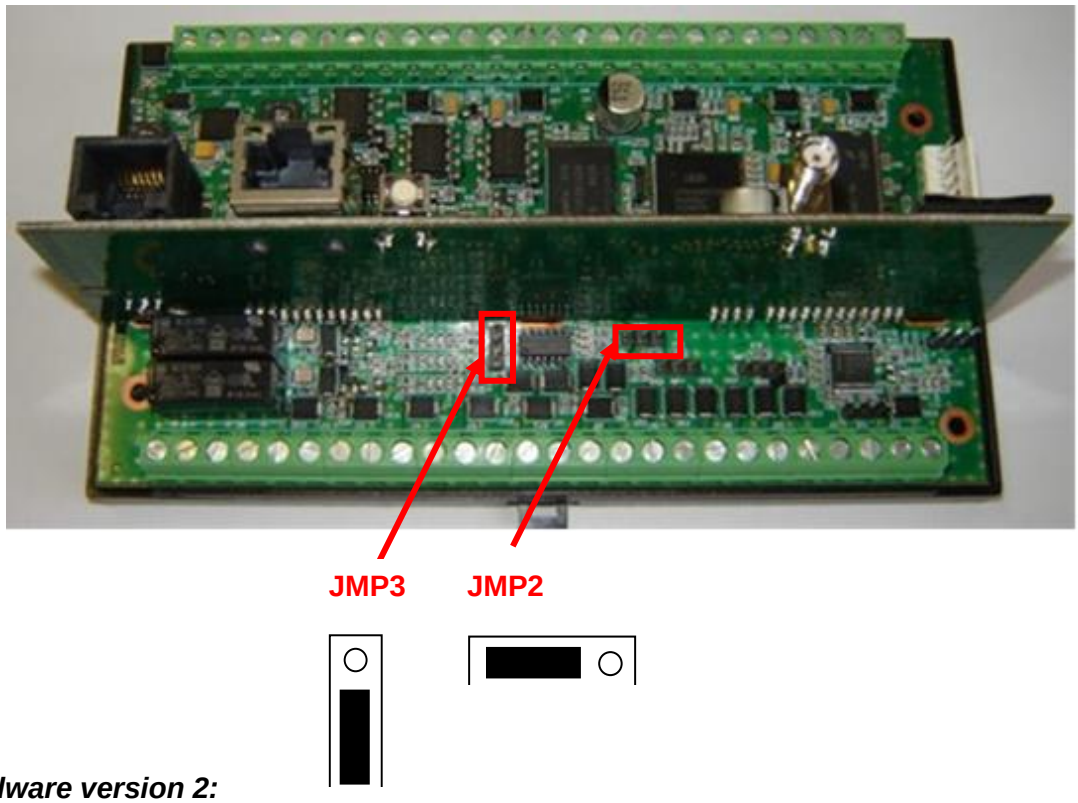
To ensure correct operation of the RS485 data bus, it must be fitted with a 120 ohm termination plug at both ends.
Depending on the position of the gateway on the bus, this plug must be enabled or disabled via a pair of jumpers mounted inside the casing.

1.1 Connecting at the end of the bus

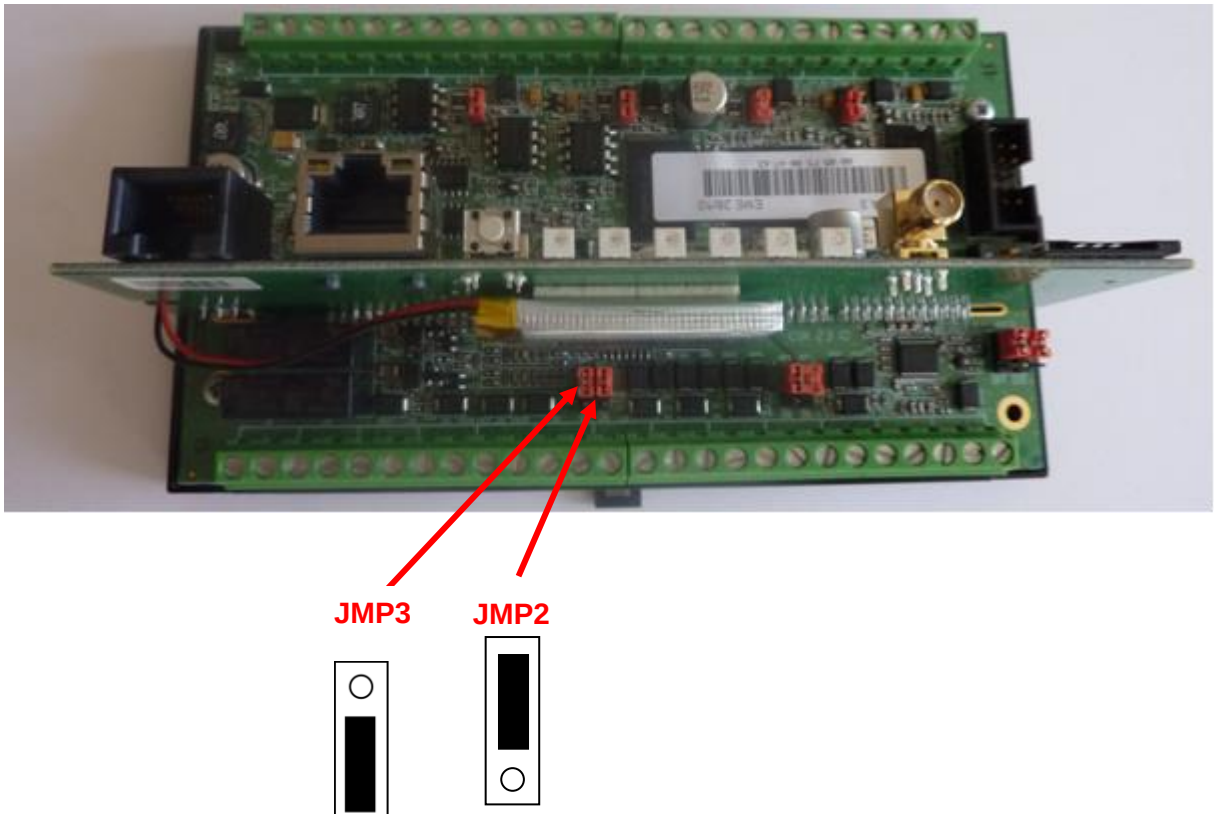
Positions of the JMP2 and JMP3 jumpers:
Only jumper JMP2 inside the casing needs to be set to activate the 120 ohm bus terminator plug.

By default, the gateway is configured to be located at the end of a 4-wire RS485 bus. Consequently, the jumpers are plugged into the “Activation” position of the 120 ohm terminator plug.
As the Kaco bus has 2 wires, jumper JMP3 must be removed.

Hardware version 1:



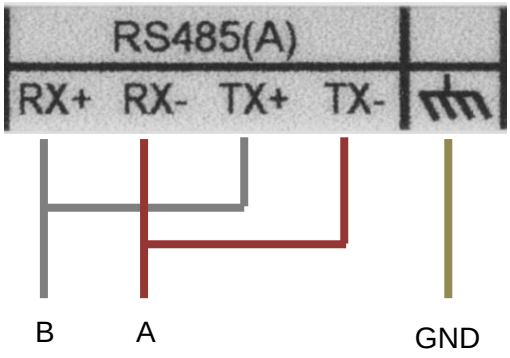
Hardware version 2:



Connecting inverters to the RS485 bus:
Consult the inverter documentation regarding the principles governing RS485 connection and wiring.

Once the RS485 cable has been brought up to the gateway:

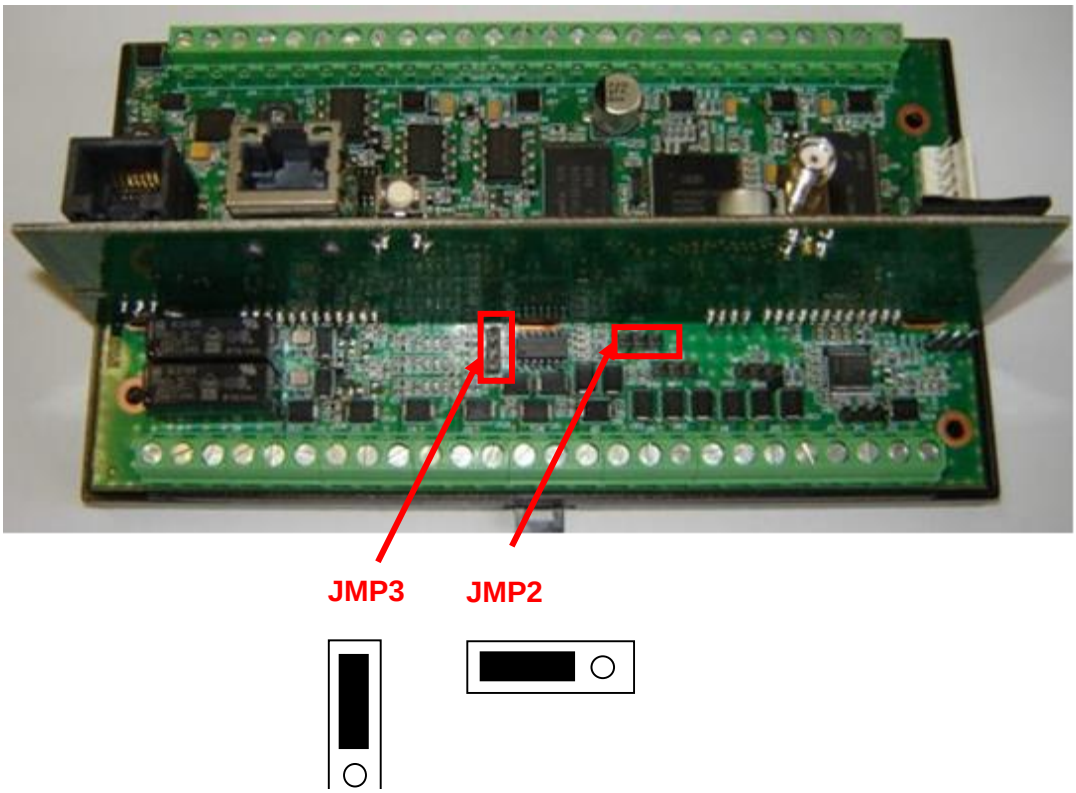
1. Strip around 4 cm of the outer sheath from the RS485 communications cable.
2. Trim the shielding back to match the cable sheath.
3. Bare around 6 mm of the wires.
4. Connect the conductors to the connector marked RS485(A), respecting the allocations in your RS485 communications bus.



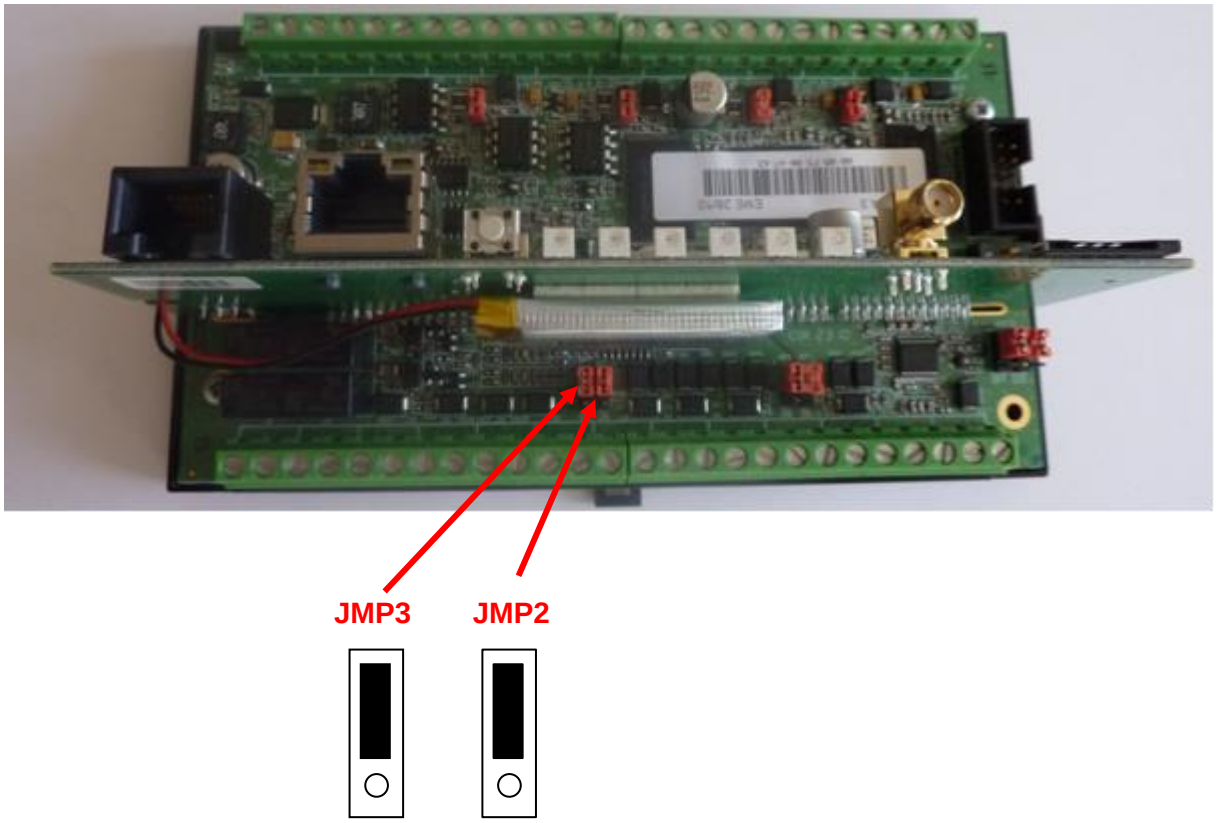
1.2 Connecting in the middle of the bus

Positions of the JMP2 and JMP3 jumpers:
Both the JMP2 and the JMP3 jumpers inside the casing must be positioned so as to deactivate the 120 ohm bus terminator plug.

Hardware version 1:



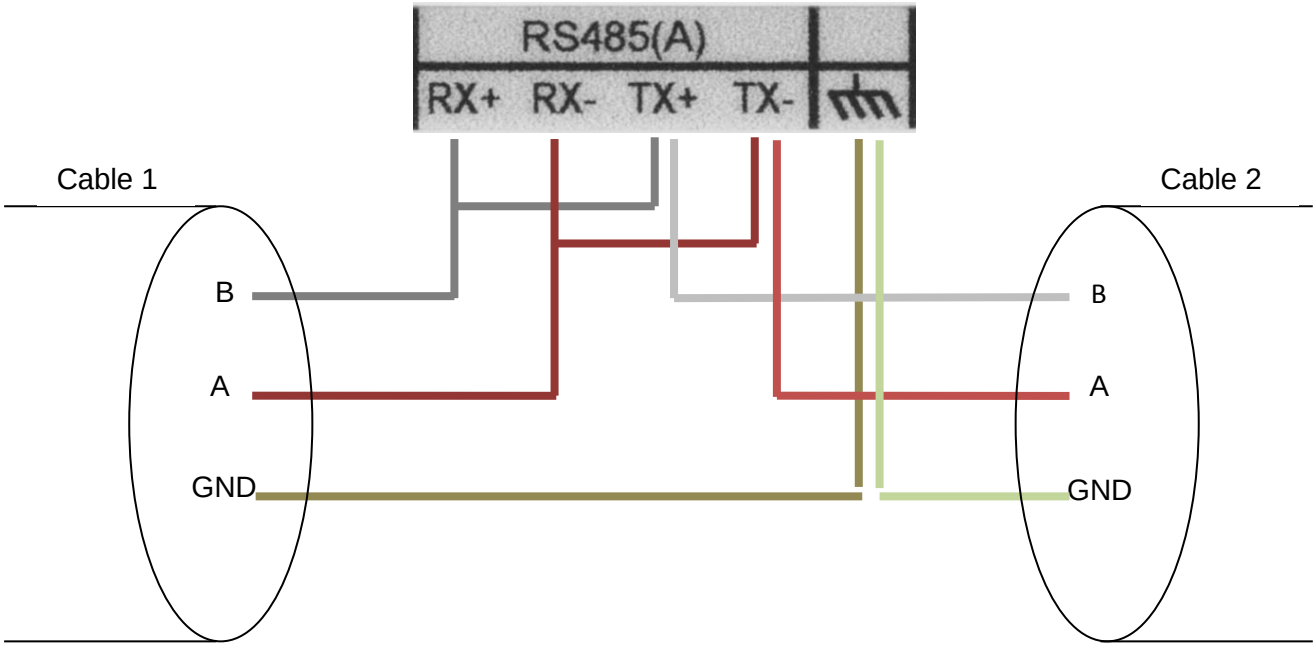
Hardware version 2:



Connecting inverters to the RS485 bus:
Consult the inverter documentation regarding the principles governing RS485 connection and wiring.

Once the two RS485 cables have been brought up to the gateway:

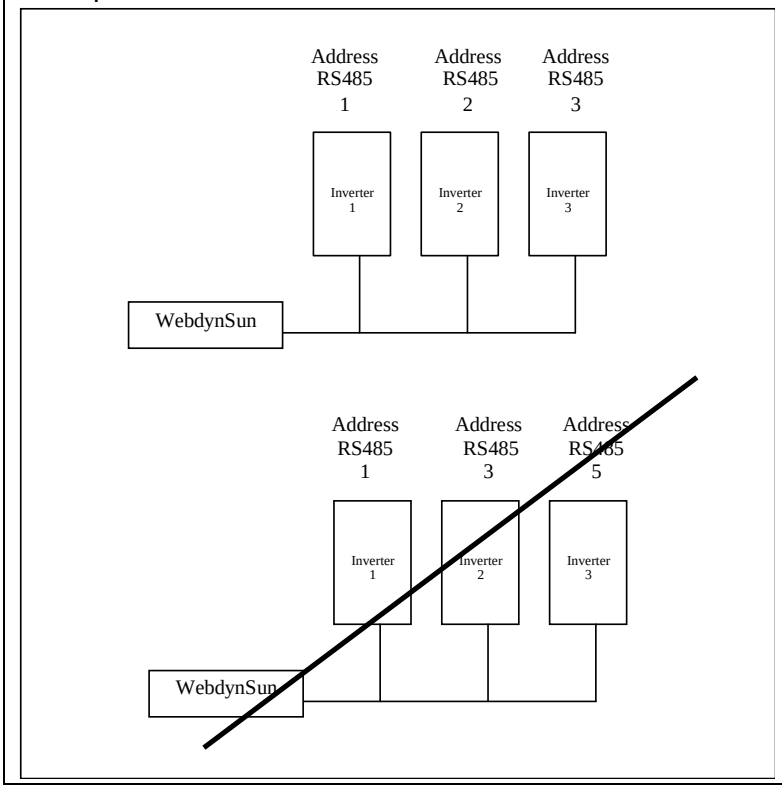
1. Strip around 4 cm of the outer sheath from the RS485 communications cables.
2. Trim the shielding back to match the cable sheath.
3. Bare around 6 mm of the wires.
4. Connect the conductors to the connector marked RS485(A), respecting the allocations in your RS485 communications bus.



2 Discovering the Kaco inverter network and the file DAQ.ini

The commands available under the Kaco protocol do not allow for setting up network addresses for the inverters.
Address allocation must therefore be carried out manually for each inverter (see inverter documentation).
The inverter addresses must be consecutive beginning with address 1.

Example:



The commands available for inverters of the Kaco type do not enable correlation between the serial number and the inverter address.
More generally, it is not possible to obtain the serial number of an inverter via the commands available under the Kaco protocol.
It is therefore a very good idea to pay very careful attention to the organisation of the file DAQ.ini

Automatic generation of the file *IDsite*_daq.ini

Network discovery is performed by reading from successive addresses. As the serial number cannot be captured, it will not be filled in.
It is replaced by the network address followed by the inverter type, separated by the underscore character "_".
At the time of the connection following this discovery, if there is no *IDsite*_daq.ini file present on the server, a file containing the whole set of devices discovered will be generated.

It is possible to modify this file to enter the serial numbers correctly. To carry out this operation, you should follow the instructions described in the next section (Manual generation of the file *IDsite*_daq.ini)

Manual generation of the file *IDsite*_daq.ini

The inverters must be declared in this file in the exact order of their addresses. The first inverter declared is the unit which has been given the address 1, the second, that at address 2, etc.
If this is not the case, the data collected will not correspond to the inverter designated by its serial number in the file *IDsite*_daq.ini.

3 Definition files for Kaco inverter families

Filename format:
*IDSite_* INV*_Family.ini*

This file is uploaded by the gateway after an inverter discovery phase. It may be modified by the user.
IDSite: site identification number.
Family: inverter family.

Example:

```
1;0;0;0;Status;-;0;0;8
2;1;0;0;Generator Voltage;V;0;0;2
3;2;0;0;Generator Current;A;0;0;2
4;3;0;0;Generator Power;W;0;0;2
5;4;0;0;Grid Voltage;V;0;0;2
6;5;0;0;Grid Current;A;0;0;2
7;6;0;0;Grid Power;W;0;0;2
8;7;0;0;Inverter Temperature;°C;0;0;2
9;8;0;0;Daily Energy;Wh;0;0;4
10;9;0;0;Version;-;0;0;1
```

This file covers all the channels on the inverter, with:
Index;field1;field 2;field 3;Name;Units;A;B;**Action**

Fields 2 and 3 are not used. Field 1 is used to identify variables within the response packet. This field enables the gateway to capture the variable based on information from the Kaco protocol.
It is the only field that must under no circumstances be modified.

The action to be applied to each variable is specified at the end of the line:

- ***Action=0***: Variable not collected.
- ***Action=1***: Variable treated as read-only parameter.
- ***Action=2***: Min/max/avg values.
- ***Action=4***: Instantaneous value.
- ***Action=8***: Variable treated as an alarm.

N.B. Depending on the variable type, several actions are applicable:

Variable type	Variable format	Possible actions
Instantaneous variables	Cumulative (variable Daily Energy)	0, 4
	State (variable Status)	0, 4, 8
	Analogue	0, 2, 4
Parameters		0, 1

N.B. If the action defined is not consistent with the variable type, it is ignored.

Special case: three-phase inverters:

Kaco Powador three-phase inverters operate differently from single-phase inverters. It is therefore essential to use the definition file described below:

```
1;0;1;0;Status L1;-;1;0;8
2;1;1;0;Generator Voltage L1;V;1;0;4
3;2;1;0;Generator Current L1;A;1;0;4
4;3;1;0;Generator Power L1;W;1;0;4
5;4;1;0;Grid Voltage L1;V;1;0;4
6;5;1;0;Grid Current L1;A;1;0;4
7;6;1;0;Grid Power L1;W;1;0;2
8;7;1;0;Inverter Temperature L1;°C;1;0;4
9;8;1;0;Daily Energy L1;kWh;0.001;0;4
10;9;1;0;Version L1;-;1;0;1
11;0;2;0;Status L2;-;1;0;8
12;1;2;0;Generator Voltage L2;V;1;0;4
13;2;2;0;Generator Current L2;A;1;0;4
14;3;2;0;Generator Power L2;W;1;0;4
15;4;2;0;Grid Voltage L2;V;1;0;4
16;5;2;0;Grid Current L2;A;1;0;4
17;6;2;0;Grid Power L2;W;1;0;2
18;7;2;0;Inverter Temperature L2;°C;1;0;4
19;8;2;0;Daily Energy L2;kWh;0.001;0;4
20;9;2;0;Version L2;-;1;0;1
21;0;3;0;Status L3;-;1;0;8
22;1;3;0;Generator Voltage L3;V;1;0;4
23;2;3;0;Generator Current L3;A;1;0;4
24;3;3;0;Generator Power L3;W;1;0;4
25;4;3;0;Grid Voltage L3;V;1;0;4
```

```
26;5;3;0;Grid Current L3;A;1;0;4

27;6;3;0;Grid Power L3;W;1;0;2
28;7;3;0;Inverter Temperature L3;°C;1;0;4
29;8;3;0;Daily Energy L3;kWh;0.001;0;4
30;9;3;0;Version L3;-;1;0;1
31;0;100;0;Grid Power;W;1;0;4
32;1;100;0;Daily Energy;kWh;1;0;4
```

4 Status variables

The following table provides information on the codes for the Status variable.
This list is not exhaustive; for further details, please consult the Kaco documentation for your inverters.
This information is an extract from the Kaco document: Instruction_manual_FR.pdf

- 1;0;0;0;Status;-;0;0;8

Status	Display	Explanation
0	The inverter has just started up	Just after the first startup in the morning.
1	Waiting to start up	The network parameters and the generator tension are being checked.
2	Waiting to shut down	About to start shutdown. Generator tension and power too low. Status before going to nightly shutdown.
3	Constant tension regulator	When supply tension is low, the inverter operates with minimal MPP tension.
4	MPP-tracker, constant monitoring movement	When sunshine is low, the MPP tracker is used to supply the network.
5	Supply mode	The inverter is supplying the network.
6	Wait mode before supplying the network. Network and solar tension test.	The inverter waits until the tension generator rises above the triggering threshold (410V), then begins the network supply process after about 3 minutes. Test of network tensions.
7	Wait mode before self-test. Network and solar tension test.	The inverter waits until the tension generator rises above the triggering threshold (410V), then begins the relay self-test after about 3 minutes. Test of network tensions.
8	Self-diagnosis	A check is made to ensure that the power electronics and network relays have been disconnected, before switching to supply mode.
10	Device temperature too high	The temperature of the device is too high (>80 °C). Above an internal temperature of 70 °C, the inverter limits the power and remains between 70 °C and 80 °C. An internal temperature of 80 °C is only reached if the convection cooling from the exterior is hampered, e.g. if the cooling fins have been obstructed.
11	Power limitation	If there is excessive power from the generator, the inverter limits itself to the maximum power. This can occur around noon if the generator design size is too great. This is not a malfunction.

12	Overload shutdown	An inverter protection function: for example, if the power delivered by the generator is too great.
13	Overload shutdown	An inverter protection function: for example, if the tension in the L1 network is too high.
14	Network failure (3-phase monitoring)	An inverter protection function: for example, if one of the three network phases has failed, or if the output tension is outside the tolerance values.
15	Shutdown: switch to night mode	The inverter is going to sleep.
18	Shutdown of the RCD module	The default current is too high.
19	Insufficient insulation resistance	The resistance of the insulation is inadequate from PV-/PV+ at PE
29	Earth leakage. Check the fuse!	A contact to earth has been found on the DC side. Check the solar generator and contact your electrical technician.
30	Measurement converter defect	The intensity and tension values measured in the inverter are implausible. This may be due to very changeable weather causing rapid switching between low supply power (e.g. 200 W) and high supply power (e.g. the maximum supply power).
31	RCD module error	An error has occurred in the RCD module.
32	Self-diagnosis error	The check on the internal network cut-off relays has failed. If this internal error occurs repeatedly, contact your electrical technician.
33	DC supply error	The network direct current supply has exceeded the permitted threshold. This direct current supply may be imposed on the Powador inverter by the network in such a way that there is no error in the inverter. If this internal error occurs repeatedly, contact your electrical technician.
34	Communications error	A communications error has occurred in internal data transmission. Contact your electrical technician to have the data line checked.
35	Protection cut-out	Software protection cutout (AC tension spike, AC current spike, spike on intermediate circuit). This is not an error but a powering down related to the network.
36	Hardware protection cut-out	Hardware protection cutout (AC tension spike, AC current spike, spike on intermediate circuit). This is not an error but a powering down related to the network.
38	PV high tension error	The tension from the PV generator is too high. The solar generator is badly designed. Contact your electrical technician.
41	L1 low network tension fault	The tension of one phase of the network is too low, so supply is impossible. The affected phase (low tension) is displayed. This fault may relate to the network.
42	L1 high network tension fault	The tension of one phase of the network is too high, so supply is impossible. The affected phase (high tension) is displayed. This fault may relate to the network.
48	Low network frequency fault	The network frequency is too low. This fault may relate to the network.
49	High network frequency fault	The network frequency is too low. This fault may relate to the network.

50	Average network tension value fault	The average value of the network tension measurement calculated over 10 mins, in line with the EN 50160 standard, has exceed the maximum allowable threshold. This fault may relate to the network.
55	Intermediate circuit error	An error occurred at the moment when the intermediate circuit was activated. Contact your electrical technician.
56	Algorithm error	An internal error occurred during execution of the calculation algorithm. Try restarting the system, or contact your electrical technician.
57	Post-error startup time	After an error, the inverter waits for a given time, predefined nationally, before reconnecting (see installation manual, chapter 3, technical characteristics).
58	Control card temperature too high	The temperature is too high. To avoid damage, the supply has been interrupted. Check that there is adequate ventilation.

5 Kaco inverter alarm files

An alarm is generated, then transmitted to the remote server in the form of a file on the FTP server (*IDSite*_AL_*YYMMDD_hhmmss*.csv.gz).
The data stored is also uploaded at the same time as an alarm.

N.B. See 4. Status variables, for an explanation of the alarm codes.

Alarm of the Kaco type:
This type of alarm is raised on a change in the status of a variable defined as an alarm in the associated definition file.

Date–Time	Type	Field 1	Field 2	Field 3	Field 4

Where:

Date–Time	Timestamp when alarm triggered, in format YY/MM/DD-hh:mm:ss
Type	INV: Alarm type is Kaco
Field 1	*IDsite*_INV_*family*.ini: Name of reference definition file
Field 2	Serial number of the triggering Kaco inverter
Field 3	1 to N: Index of the triggering data item in the associated definition file.
Field 4	Status of the trigger item: 0 to n => Code corresponding to status messages or to messages indicating inverter malfunction.

Example:

09/10/09-08:45:38;INV;WEBDYN01_INV_3000xi.ini;70201071;10;2

Mechanism for censoring alarms

For status variables configured as alarms, it is possible to specify, in the definition file, which values are to be censored, i.e. for which an alarm report should not be uploaded, even though the action code is 8.

This mechanism means that an alarm is not uploaded if the value taken by a variable with an action code of 8 has been declared in the list of values to be ignored.

The list of values to be ignored is specific to each variable declared in the definition file with the action code Alarm (8), and is written in the field following that containing the Alarm action code.
The values to be censored are separated by the pipe symbol "|".

Example with the variable Status:
The declaration line for this variable is in the definition file.

```
1;0;0;0;Status;-;0;0;8;15|12|58
```

In this case, if the variable switches to a value of 15 (Shutdown: switch to night mode), 12 (Overload shutdown) or 58 (Control card temperature too high), the new value will indeed be saved to the data file, but no alarm will be uploaded.

6 Kaco inverter parameter files

Filename format:
*IDSite*_INV_P_*YYMMDD_hhmmss*.csv.gz
Where:
IDSite: gateway identifier.

The parameters of the inverters present on the network are sent to the FTP server in two cases:

- By pressing the push-button on the gateway;
- Via a command file of the type GATEWAY: Send inverter parameters (*see chapter on managing command files in the User's Manual*).

The file format is as follows: (fields in green are optional data that can be enabled or disabled in *IDSite*_daq.ini (*see* section *7.3. Declaring and configuring inverters* in the User's Manual)).

```
SNINV;70201071;1;
TypeINV;WD0047EC_INV_3000xi.ini;
1;10
16/11/10-15:23:54;3000xi;
```

For each inverter, this file details the variables defined as parameters in the file *IDSite*_INV_*family*.ini *(see Chapter 3: Definition files for Kaco inverter families)*.

SNINV = Serial number of inverter n (n=0 to 99).

TypeINV = Family of inverter n.

The column heading ";1;2;3;4;5;…;" is added if the option (DAQ_HeaderOption) is enabled in *IDSite*_daq.ini (*see* section *7.3. Declaring and configuring inverters* in the User's Manual).

The communications protocol of Kaco inverters only enables the inverter version to be captured.

To minimise the sizes of transmitted files, the parameter file is compressed in .gz format.

7 Kaco inverter parameter modification command files

Modification of inverter parameters is not provided under the Kaco protocol.