Watch Dog for Photovoltaic Power Plant
Settings parameters and system Specifications
Ville de Montpellier 3M – PISE – DDSE – SEGF – LS

Site			
Param.#	**Information**	**Format**	**Value**
1	Site ID (short name)	String / 3	« RIC »
2	Total peak power (kW)	uint16_t	67
3	Total surface of panels (m²)	uint16_t	327
4	Number of inverters	uint8_t	5
5	Expected total AC power calculation period	uint8_t	2
6	Modbus slave ID of the system	uint8_t	
7	*Reserved*		
8	*Reserved*		
9	*Reserved*		
10	*Reserved*		

Network			
Param.#	**Information**	**Format**	**Valeur**
21	IP	4 * uint8_t	10.101.49.247
22	Subnet mask	4 * uint8_t	255.255.255.0
23	IP Gateway	4 * uint8_t	10.101.49.254
24	DNS	4 * uint8_t	10.101.22.65
25	*Reserved*		
26	*Reserved*		
27	*Reserved*		
28	*Reserved*		
29	*Reserved*		
30	*Reserved*		

InfluxDB time data base			
Param.#	**Information**	**Format**	**Valeur**
31	InfluxDB server IP address	4 * uint8_t	10.60.1.14
32	Port	uint16_t	8093
33	Database ID/name	String / 3	« EPF »
34	Tag 1 / Site ID	String / 5	« RIC »
35	Metric 1 / Solar irradiation W/m²	String / 5	« Irrad »
36	Metric 2 / Expected AC power (kW)	String / 5	« Patt »
37	Metric 3 / Current AC power (kW)	String / 5	« Pinj »
38	Metric 4 / Failure code	String / 5	« D1 »
39	Metric 5 / Air/panels temperature	String / 5	« Temp »
40	*Reserved*	String / 5	

UDP message structure string : « `Irrad,Site=RIC value=100` »

SMTP server			
Param.#	**Information**	**Format**	**Valeur**
31	URL (no authentication)	String / 100	« smtp.ville-montpellier.org »
32	Port	uint8_t	25
33	Email address of the system	String / 100	«SWD_Richier@ville-montpellier.fr»
34	Recipient 1 email address	String / 100	« L.SERRA@montpellier3m.fr»
35	Recipient 2 email address	String / 100	« X.YYYY@montpellier3m.fr»
36	Recipient 3 email address	String / 100	« X.YYYY@montpellier3m.fr»
37	Recipient 4 email address	String / 100	« X.YYYY@montpellier3m.fr»
38	*Reserved*		
39	*Reserved*		
40	*Reserved*		

Main power meter (LSTIC / Modbus TCP, port 502)			
Param.#	**Information**	**Format**	**Valeur**
41	IP address	4 * uint8_t	10.101.49.243
42	Slave ID	uint8_t	100
43	Register number for total injected AC power	uint16_t	31
44	Function code to read injected AC power	uint8_t	3
45	Scale factor	int8_t	1 (1)
46	*Reserved*		
47	*Reserved*		
48	*Reserved*		
49	*Reserved*		
50	*Reserved*		

(1) Scale factor: -3:0,001 -2:0,01 -1:0,1 0:1, 1:10 2:100 3:1000

Inverter data (0 < Inverter id < 9)			
Param.#	**Information**	**Format**	**Valeur**
51	IP address	4 * uint8_t	10.101.49.244
52	Slave ID	uint8_t	1
53	Register number for AC power	uint16_t	31
54	Function code to read AC power register	uint8_t	3
55	AC power register format	int8_t	(1)
56	Scale factor (kW)	int8_t	(2)
57	Register number for operating state	uint16_t	
58	Function code to read operating state register	uint8_t	3
59	Operating state format	uint16_t	(1)
60	Operating state value when OK/run	uint16_t	
61	Surface of panels connected to this inverter (m^2)	uint16_t	

(1) Format : 0:Uint16_t, 1:Unit32_t, 2:Float32

(2) Scale factor: -3:0,001 -2:0,01 -1:0,1 0:1, 1:10 2:100 3:1000

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Param.# vs Inverter Id									
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
51	71	91	111	131	151	171	191	211	231
61	81	101	121	141	161	181	201	221	241

Solar irradiation sensor			
Param.#	**Information**	**Format**	**Valeur**
301	Output voltage @ 1000W/m² (mV)	uint16_t	76
302	*Reserved*		
303	*Reserved*		
304	*Reserved*		
304	*Reserved*		
305	*Reserved*		
306	*Reserved*		
307	*Reserved*		
308	*Reserved*		
309	*Reserved*		

Failure detection activation			
Param.#	**Failure**	**Format**	**Valeur**
310	Complete power failure (main power meter is 0)	uint8_t	1/0
311	Complete or partial power failure of Inverter 0	uint8_t	1/0
313	Complete or partial power failure of Inverter 1	uint8_t	1/0
314	Complete or partial power failure of Inverter 2	uint8_t	1/0
314	Complete or partial power failure of Inverter 3	uint8_t	1/0
315	Complete or partial power failure of Inverter 4	uint8_t	1/0
316	Complete or partial power failure of Inverter 5	uint8_t	1/0
317	Complete or partial power failure of Inverter 6	uint8_t	1/0
318	Complete or partial power failure of Inverter 7	uint8_t	1/0
319	Complete or partial power failure of Inverter 8	uint8_t	1/0
320	Complete or partial power failure of Inverter 8	uint8_t	1/0
321	Main meter query failure (no reply from the power meter)	uint8_t	1/0
322	Solar irradiation sensor failure (value out of range)	uint8_t	1/0
323	Temperature sensor failure (value out of range)	uint8_t	1/0
324	*Reserved*		
326	*Reserved*		

1 : failure detection is enabled, 0 : Failure detection is disabled

Modbus registers table of the system (1)			
IR	**Information**	**Format**	**Unit**
1	Solar irradiation sensor value	uint16_t	W/m²
2	Panels/air temperature	uint16_t	°C
3	Total injected AC power	uint16_t	kW
4	Total calculated/expected AC power	uint16_t	kW
5	Current active failures code	uint16_t	
6	*Reserved*	uint16_t	
7	*Reserved*	uint16_t	
8	*Reserved*	uint16_t	
9	*Reserved*	uint16_t	
10	*Reserved*	uint16_t	

REM : Clients (aka masters) have to use the function code 04 (read input registers) to read data from the system.

Failures detection

Input variables:

- TIP : Total AC injected power (kW)
- T: Panel or air temperature (°C)
- TSP : Total surface of panels (m^2)
- Irrad: Solar irradiation (W/m^2)
- E(T) : Panels efficiency, temperature derated value (%)
- TEP : Total expected AC power = TSP * Irrad * E(T) (kW)
- IxP : Current inverter x AC power (kW)
- IxSP : Surface of panel connected to the inverter x (m^2)
- IxSR : Surface ratio for the inverter x = IxSP / TSP (%)
- IxEP : Expected AC power for the inverter x : Pinj * IxSR (kW)

x = Inverter Id

We assume that the inverter power is directly proportional to its surface ratio.

All the panels have the same orientation and tilt, and there is no shadow cast.

If inverter 1 has 20% of the total surface of panels, and total power is 100 kW then, inverter 1 power must be around 20 kW.

Failures

Failures detection are enabled or disabled using settings 310 to 326.

Failure detection is disabled when solar irradiation sensor value is below 100 W/m^2. (i.e at night, dusk, dawn, and in bad weather condition…)

Reason	Code	E-mail delay
• Complete power failure (TIP = 0)	01	2 h
• Complete power failure of inverter x (IxP = 0)	02	2 h
• Patial power failure of inverter x (IxP << IxEP)	03	8 h
• Communication failure with inverters	04	2 h
• Communication failure with main power meter	05	2 h
• Solar irradiation sensor value out of range	06	2 h
• Temperature sensor value out of range	07	2 h