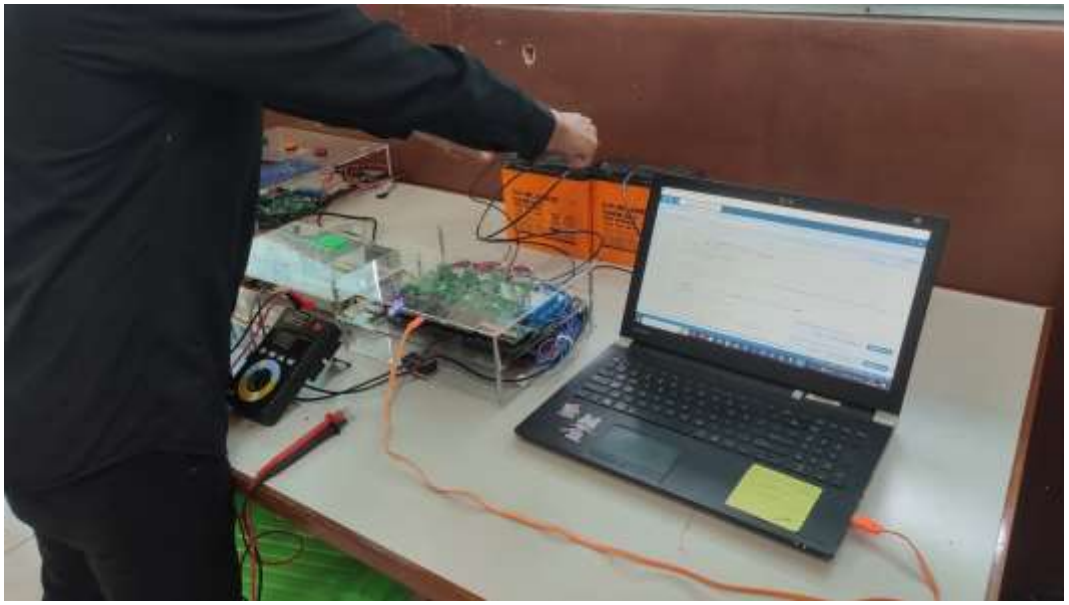
LAMPIRAN

LAMPIRAN I



DATA PENGUJIAN CHARGING DENGAN ALGORITMA *ANT COLONY*

Time (s)	Voltage	Current	Estimasi SOC
0	12,98	5,00	56
1	12,98	5,00	56
2	12,98	5,00	56
3	12,98	5,00	56
4	12,99	5,00	56
5	12,99	5,00	57
6	12,99	5,00	57
7	12,99	5,00	57
8	12,99	5,00	57
9	13,00	5,00	57
10	13,00	4,98	57
11	13,00	4,98	57
12	13,00	5,00	57
13	13,01	5,00	57
14	13,01	5,00	57
15	13,01	5,00	57
16	13,01	4,99	57
17	13,02	4,99	58
18	13,02	4,99	58
19	13,02	4,99	58
20	13,03	5,00	58
21	13,03	5,00	58
22	13,03	5,00	58
23	13,03	5,00	58
24	13,03	5,00	58
25	13,03	5,00	58
26	13,04	5,00	58
27	13,04	4,98	58
28	13,04	4,98	58
29	13,04	4,98	58
30	13,04	5,00	58
31	13,05	5,00	59
32	13,05	5,00	59
33	13,05	5,00	59
34	13,05	5,00	59
35	13,05	4,99	59
36	13,05	4,99	59
37	13,06	4,99	59

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
38	13,06	4,99	59
39	13,06	4,97	59
40	13,06	4,97	59
41	13,07	4,97	59
42	13,07	4,97	59
43	13,07	5,00	59
44	13,07	5,00	59
45	13,08	5,00	59
46	13,08	5,00	59
47	13,08	5,00	59
48	13,08	5,00	59
49	13,09	4,98	59
50	13,09	4,98	60
51	13,09	4,98	60
52	13,09	4,97	60
53	13,10	4,97	60
54	13,10	4,97	60
55	13,10	4,97	60
56	13,10	4,97	60
57	13,11	4,97	60
58	13,11	4,94	60
59	13,11	4,94	60
60	13,11	4,94	60
61	13,11	4,94	60
62	13,11	4,94	60
63	13,12	4,86	60
64	13,12	4,86	61
65	13,12	4,86	61
66	13,13	4,86	61
67	13,13	4,86	61
68	13,13	4,89	61
69	13,13	4,89	61
70	13,13	4,89	61
71	13,14	4,89	61
72	13,14	4,85	61
73	13,14	4,85	61
74	13,14	4,85	61
75	13,14	4,85	61
76	13,15	4,85	61

Time (s)	Voltage	Current	Estimasi SOC
78	13,15	4,85	61
79	13,15	4,82	61
80	13,16	4,82	62
81	13,16	4,82	62
82	13,16	4,82	62
83	13,16	4,82	62
84	13,16	4,82	62
85	13,17	4,81	62
86	13,17	4,81	62
87	13,17	4,81	62
88	13,17	4,81	62
89	13,18	4,81	62
90	13,18	4,81	62
91	13,18	4,81	62
92	13,18	4,81	62
93	13,19	4,81	63
94	13,19	4,86	63
95	13,19	4,86	63
96	13,19	4,86	63
97	13,19	4,86	63
98	13,20	4,87	63
99	13,20	4,87	63
100	13,20	4,87	63
101	13,20	4,87	63
102	13,21	4,87	63
103	13,21	4,84	63
104	13,22	4,84	63
105	13,22	4,84	63
106	13,22	4,84	63
107	13,23	4,84	64
108	13,23	4,84	64
109	13,23	4,84	64
110	13,24	4,82	64
111	13,24	4,82	64
112	13,24	4,82	64
113	13,25	4,82	64
114	13,25	4,82	64
115	13,25	4,80	64
116	13,25	4,80	64
117	13,26	4,80	64

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
118	13,26	4,80	65
119	13,26	4,80	65
120	13,26	4,80	65
121	13,27	4,83	65
122	13,27	4,83	65
123	13,27	4,83	65
124	13,27	4,83	65
125	13,28	4,83	65
126	13,28	4,83	65
127	13,29	4,86	65
128	13,29	4,86	65
129	13,29	4,86	65
130	13,29	4,86	65
131	13,29	4,86	65
132	13,31	4,86	66
133	13,31	4,84	66
134	13,31	4,84	66
135	13,31	4,84	66
136	13,32	4,84	66
137	13,32	4,84	66
138	13,33	4,84	67
139	13,33	4,81	67
140	13,33	4,81	67
141	13,34	4,81	67
142	13,34	4,81	67
143	13,34	4,81	67
144	13,35	4,81	67
145	13,35	4,81	67
146	13,35	4,80	67
147	13,36	4,80	67
148	13,36	4,80	67
149	13,36	4,80	67
150	13,37	4,75	68
151	13,37	4,75	68
152	13,38	4,75	68
153	13,38	4,75	68
154	13,38	4,75	68
155	13,38	4,75	68
156	13,39	4,75	68

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
157	13,39	4,63	68
158	13,39	4,63	68
159	13,39	4,63	68
160	13,42	4,63	69
161	13,42	4,63	69
162	13,42	4,54	69
163	13,42	4,54	69
164	13,44	4,54	70
165	13,44	4,54	70
166	13,45	4,54	70
167	13,45	4,54	70
168	13,46	4,54	70
169	13,46	4,54	70
170	13,46	4,52	70
171	13,47	4,52	70
172	13,47	4,52	70
173	13,47	4,52	70
174	13,48	4,52	70
175	13,48	3,54	71
176	13,48	3,54	71
177	13,50	3,49	71
178	13,50	3,49	71
179	13,50	3,49	71
180	13,50	3,49	71
181	13,51	3,49	72
182	13,51	3,49	72
183	13,52	3,46	72
184	13,52	3,46	72
185	13,52	3,46	72
186	13,53	3,46	72
187	13,53	3,46	72
188	13,53	3,46	72
189	13,55	3,46	72
190	13,55	3,46	73
191	13,55	3,46	73
192	13,56	3,37	73
193	13,56	3,37	73
194	13,56	3,35	73
195	13,57	3,35	73

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
196	13,57	3,35	73
197	13,57	3,31	73
198	13,58	3,31	74
199	13,58	3,31	74
200	13,59	3,31	74
201	13,59	3,31	74
202	13,59	3,26	74
203	13,61	3,26	75
204	13,61	3,26	75
205	13,61	3,26	75
206	13,62	3,24	75
207	13,62	3,24	75
208	13,62	3,24	75
209	13,62	3,24	75
210	13,62	3,22	75
211	13,63	3,22	75
212	13,63	3,22	75
213	13,64	3,22	75
214	13,64	3,19	75
215	13,64	3,19	75
216	13,65	3,19	75
217	13,65	3,19	76
218	13,65	3,19	76
219	13,65	3,18	76
220	13,65	3,18	76
221	13,66	3,18	76
222	13,66	3,18	76
223	13,66	3,18	76
224	13,66	3,18	76
225	13,66	3,16	76
226	13,67	3,16	76
227	13,67	3,16	76
228	13,68	3,16	76
229	13,68	3,16	76
230	13,68	3,16	76
231	13,69	3,16	77
232	13,69	3,16	77
233	13,69	3,14	77
234	13,69	3,14	77

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
235	13,70	3,14	77
236	13,70	3,14	77
237	13,70	3,14	77
238	13,71	3,13	77
239	13,71	3,13	77
240	13,71	3,13	77
241	13,71	3,13	77
242	13,72	3,13	78
243	13,72	3,13	78
244	13,72	3,13	78
245	13,72	3,12	78
246	13,73	3,12	78
247	13,73	3,12	78
248	13,73	3,10	78
249	13,73	3,10	78
250	13,74	3,10	78
251	13,74	3,10	78
252	13,74	3,10	78
253	13,74	3,10	78
254	13,75	3,10	78
255	13,75	3,09	79
256	13,75	3,09	79
257	13,76	3,09	79
258	13,76	3,09	79
259	13,76	3,09	79
260	13,76	3,09	79
261	13,77	3,08	79
262	13,77	3,08	79
263	13,77	3,08	79
264	13,78	3,08	79
265	13,78	3,07	79
266	13,78	3,07	79
267	13,78	3,07	79
268	13,78	3,07	79
269	13,79	3,07	80
270	13,79	3,07	80
271	13,79	3,07	80
272	13,79	3,05	80
273	13,80	3,05	80

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
274	13,80	3,05	80
275	13,80	3,05	80
276	13,80	3,05	80
277	13,80	3,04	80
278	13,81	3,04	80
279	13,81	3,04	80
280	13,81	3,04	80
281	13,81	3,03	80
282	13,81	3,03	80
283	13,82	3,03	81
284	13,82	3,03	81
285	13,82	3,03	81
286	13,82	3,03	81
287	13,82	3,03	81
288	13,83	3,02	81
289	13,83	3,02	81
290	13,83	3,02	81
291	13,83	3,05	81
292	13,83	3,02	81
293	13,84	3,02	81
294	13,84	3,02	81
295	13,85	3,02	81
296	13,85	3,02	81
297	13,85	3,02	81
298	13,85	3,02	81
299	13,85	3,02	81
300	13,86	3,02	82
301	13,86	3,01	82
302	13,86	3,01	82
303	13,86	3,01	82
304	13,86	3,01	82
305	13,86	3,01	82
306	13,87	3,01	82
307	13,87	3,01	82
308	13,87	3,01	82
309	13,88	3,01	82
310	13,88	3,01	82
311	13,88	3,01	82
312	13,89	3,01	83

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
313	13,89	3,00	83
314	13,89	3,00	83
315	13,90	3,00	83
316	13,90	3,00	83
317	13,90	3,00	83
318	13,90	3,00	83
319	13,90	3,00	83
320	13,91	3,00	83
321	13,91	3,00	83
322	13,91	3,00	83
323	13,91	3,00	83
324	13,91	3,00	83
325	13,91	2,84	83
326	13,91	2,84	83
327	13,92	2,84	83
328	13,92	2,84	83
329	13,92	2,84	83
330	13,92	2,84	83
331	13,93	2,84	84
332	13,93	2,84	84
333	13,93	2,84	84
334	13,93	2,84	84
335	13,94	2,84	84
336	13,94	2,84	84
337	13,94	2,84	84
338	13,94	2,84	84
339	13,94	2,84	84
340	13,95	2,84	84
341	13,95	2,84	84
342	13,95	2,84	84
343	13,95	2,84	84
344	13,95	2,84	84
345	13,95	2,84	84
346	13,96	2,84	85
347	13,96	2,84	85
348	13,96	2,83	85
349	13,96	2,84	85
350	13,96	2,83	85
351	13,96	2,83	85

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
352	13,97	2,83	85
353	13,97	2,83	85
354	13,97	2,83	85
355	13,97	2,83	85
356	13,97	2,83	85
357	13,97	2,83	85
358	13,97	2,83	85
359	13,98	2,83	85
360	13,98	2,83	85
361	13,98	2,83	85
362	13,98	2,83	85
363	13,98	2,83	85
364	13,98	2,83	85
365	13,98	2,83	85
366	13,98	2,83	85
367	13,98	2,83	85
368	13,99	2,83	85
369	13,99	2,83	85
370	13,99	2,83	85
371	13,99	2,83	85
372	13,99	2,83	85
373	14,00	2,83	86
374	14,00	2,83	86
375	14,00	2,83	86
376	14,00	2,83	86
377	14,00	2,83	86
378	14,00	2,83	86
379	14,01	2,83	86
380	14,01	2,82	86
381	14,01	2,83	86
382	14,01	2,83	86
383	14,02	2,83	86
384	14,02	2,83	86
385	14,02	2,83	86
386	14,02	2,83	86
387	14,02	2,83	86
388	14,02	2,82	86
389	14,03	2,83	87
390	14,03	2,82	87

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
393	14,03	2,82	87
394	14,03	2,82	87
395	14,03	2,82	87
396	14,04	2,82	87
397	14,04	2,82	87
398	14,04	2,82	87
399	14,04	2,82	87
400	14,05	2,82	87
401	14,05	2,82	87
402	14,05	2,82	87
403	14,05	2,82	87
404	14,05	2,82	87
405	14,06	2,82	87
406	14,06	2,82	87
407	14,06	2,82	87
408	14,06	2,82	87
409	14,06	2,82	87
410	14,06	2,82	87
411	14,06	2,82	87
412	14,07	2,82	88
413	14,07	2,82	88
414	14,07	2,81	88
415	14,07	2,81	88
416	14,07	2,81	88
417	14,07	2,81	88
418	14,07	2,81	88
419	14,08	2,81	88
420	14,08	2,81	88
421	14,08	2,81	88
422	14,08	2,81	88
423	14,08	2,81	88
424	14,08	2,81	88
425	14,09	2,81	88
426	14,09	2,81	88
427	14,09	2,81	88
428	14,09	2,80	88
429	14,09	2,81	88
430	14,09	2,81	88
431	14,09	2,80	88

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
432	14,09	2,80	88
433	14,09	2,80	88
434	14,10	2,80	89
435	14,10	2,80	89
436	14,10	2,80	89
437	14,10	2,80	89
438	14,10	2,80	89
439	14,10	2,80	89
440	14,11	2,80	89
441	14,11	2,80	89
442	14,11	2,80	89
443	14,11	2,80	89
444	14,11	2,80	89
445	14,11	2,80	89
446	14,11	2,80	89
447	14,11	2,80	89
448	14,12	2,80	89
449	14,12	2,80	89
450	14,12	2,80	89
451	14,12	2,79	89
452	14,12	2,80	89
453	14,12	2,79	89
454	14,12	2,79	89
455	14,12	2,80	89
456	14,13	2,78	89
457	14,13	2,78	89
458	14,13	2,78	89
459	14,13	2,78	89
460	14,13	2,78	89
461	14,13	2,78	89
462	14,13	2,78	89
463	14,13	2,78	89
464	14,13	2,78	89
465	14,13	2,77	89
466	14,14	2,78	90
467	14,14	2,78	90
468	14,14	2,78	90
469	14,14	2,77	90
470	14,14	2,77	90

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
471	14,15	2,77	90
472	14,15	2,78	90
473	14,15	2,77	90
474	14,15	2,77	90
475	14,15	2,77	90
476	14,15	2,77	90
477	14,16	2,77	90
478	14,16	2,72	90
479	14,16	2,72	90
480	14,16	2,72	90
481	14,16	2,72	90
482	14,16	2,72	90
483	14,16	2,72	90
484	14,16	2,72	90
485	14,16	2,72	90
486	14,16	2,72	90
487	14,16	2,72	90
488	14,16	2,72	90
489	14,16	2,72	90
490	14,16	2,72	90
491	14,17	2,72	90
492	14,17	2,46	91
493	14,17	2,46	91
494	14,17	2,29	91
495	14,17	2,29	91
496	14,17	2,29	91
497	14,17	2,29	91
498	14,17	2,29	91
499	14,17	2,29	91
500	14,17	2,29	91
501	14,17	2,29	91
502	14,18	2,29	91
503	14,18	2,29	91
504	14,18	2,29	91
505	14,18	2,29	91
506	14,18	2,28	91
507	14,18	2,29	91
508	14,18	2,29	91
509	14,19	2,28	91

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
510	14,19	2,28	91
511	14,19	2,28	91
512	14,19	2,27	91
513	14,19	2,27	91
514	14,19	2,27	91
515	14,19	2,27	91
516	14,19	2,22	91
517	14,19	2,22	91
518	14,19	2,22	91
519	14,20	2,22	91
520	14,20	2,22	91
521	14,20	2,22	91
522	14,20	2,22	91
523	14,20	2,22	91
524	14,20	2,22	91
525	14,20	2,22	91
526	14,20	2,22	91
527	14,21	2,22	92
528	14,21	2,22	92
529	14,21	2,22	92
530	14,21	2,25	92
531	14,21	2,25	92
532	14,21	2,25	92
533	14,21	2,25	92
534	14,22	2,25	92
535	14,22	2,25	92
536	14,22	2,25	92
537	14,22	2,25	92
538	14,22	2,25	92
539	14,22	2,25	92
540	14,22	2,25	92
541	14,22	2,25	92
542	14,23	2,25	92
543	14,23	2,24	92
544	14,23	2,24	92
545	14,23	2,24	92
546	14,23	2,24	92
547	14,23	2,24	92
548	14,23	2,24	92

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
549	14,24	2,24	93
550	14,24	2,24	93
551	14,24	2,24	93
552	14,24	2,24	93
553	14,24	2,24	93
554	14,24	2,24	93
555	14,24	2,24	93
556	14,25	2,23	93
557	14,25	2,23	93
558	14,25	2,23	93
559	14,25	2,23	93
560	14,25	2,23	93
561	14,25	2,23	93
562	14,25	2,23	93
563	14,25	2,22	93
564	14,25	2,21	93
565	14,25	2,21	93
566	14,26	2,21	93
567	14,26	2,21	93
568	14,26	2,21	93
569	14,26	2,21	93
570	14,26	2,21	93
571	14,26	2,20	93
572	14,26	2,20	93
573	14,26	2,20	93
574	14,27	2,20	93
575	14,27	1,99	93
576	14,27	1,98	93
577	14,27	1,95	93
578	14,27	1,94	93
579	14,27	1,93	93
580	14,27	1,90	93
581	14,27	1,88	93
582	14,27	1,87	93
583	14,28	1,85	94
584	14,28	1,84	94
585	14,29	1,83	94
586	14,28	1,83	94
587	14,28	1,81	94

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
588	14,28	1,80	94
589	14,29	1,79	94
590	14,29	1,77	94
591	14,29	1,77	94
592	14,29	1,76	94
593	14,29	1,76	94
594	14,29	1,74	94
595	14,31	1,74	95
596	14,30	1,73	94
597	14,31	1,73	95
598	14,30	1,72	94
599	14,31	1,72	95
600	14,31	1,70	95
601	14,31	1,70	95
602	14,31	1,69	95
603	14,31	1,69	95
604	14,31	1,69	95
605	14,31	1,67	95
606	14,32	1,67	95
607	14,32	1,66	95
608	14,32	1,66	95
609	14,32	1,64	95
610	14,32	1,64	95
611	14,32	1,64	95
612	14,32	1,63	95
613	14,32	1,63	95
614	14,32	1,62	95
615	14,32	1,62	95
616	14,33	1,62	95
617	14,33	1,62	95
618	14,33	1,62	95
619	14,32	1,60	95
620	14,32	1,59	95
621	14,33	1,58	95
622	14,33	1,58	95
623	14,33	1,58	95
624	14,33	1,58	95
625	14,33	1,56	95
626	14,34	1,56	95

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
627	14,34	1,56	95
628	14,34	1,56	95
629	14,34	1,55	95
630	14,34	1,55	95
631	14,34	1,55	95
632	14,34	1,55	95
633	14,35	1,53	96
634	14,35	1,53	96
635	14,35	1,53	96
636	14,35	1,53	96
637	14,36	1,52	96
638	14,35	1,52	96
639	14,36	1,52	96
640	14,36	1,52	96
641	14,36	1,50	96
642	14,36	1,50	96
643	14,36	1,50	96
644	14,36	1,49	96
645	14,36	1,49	96
646	14,37	1,49	96
647	14,37	1,49	96
648	14,37	1,49	96
649	14,37	1,48	96
650	14,37	1,48	96
651	14,37	1,48	96
652	14,37	1,48	96
653	14,39	1,46	97
654	14,39	1,46	97
655	14,39	1,46	97
656	14,39	1,46	97
657	14,39	1,45	97
658	14,39	1,45	97
659	14,39	1,45	97
660	14,39	1,45	97
661	14,39	1,45	97
662	14,39	1,44	97
663	14,40	1,44	97
664	14,40	1,44	97
665	14,40	1,44	97

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
666	14,40	1,44	97
667	14,40	1,44	97
668	14,40	1,42	97
669	14,40	1,42	97
670	14,40	1,42	97
671	14,40	1,41	97
672	14,40	1,41	97
673	14,42	1,41	98
674	14,42	1,41	98
675	14,42	1,41	98
676	14,42	1,41	98
677	14,42	1,39	98
678	14,42	1,39	98
679	14,42	1,39	98
680	14,42	1,39	98
681	14,42	1,39	98
682	14,42	1,38	98
683	14,41	1,36	97
684	14,43	1,36	98
685	14,43	1,36	98
686	14,44	1,36	98
687	14,44	1,36	98
688	14,44	1,36	98
689	14,44	1,35	98
690	14,45	1,35	99
691	14,45	1,35	99
692	14,45	1,35	99
693	14,45	1,35	99
694	14,45	1,35	99
695	14,45	1,35	99
696	14,45	1,34	99
697	14,45	1,34	99
698	14,46	1,34	99
699	14,46	1,34	99
700	14,46	1,34	99
701	14,46	1,34	99
702	14,46	1,32	99
703	14,46	1,32	99
704	14,46	1,32	99

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
705	14,46	1,32	99
706	14,46	1,31	99
707	14,45	1,31	99
708	14,46	1,31	99
709	14,46	1,31	99
710	14,46	1,31	99
711	14,46	1,31	99
712	14,46	1,31	99
713	14,46	1,31	99
714	14,46	1,31	99
715	14,46	1,29	99
716	14,47	1,29	99
717	14,47	1,29	99
718	14,47	1,29	99
719	14,47	1,28	99
720	14,47	1,28	99
721	14,47	1,28	99
722	14,47	1,28	99
723	14,47	1,28	99
724	14,47	1,27	99
725	14,47	1,27	99
726	14,47	1,27	99
727	14,47	1,27	99
728	14,48	1,27	99
729	14,48	1,27	99
730	14,48	1,27	99
731	14,48	1,27	99
732	14,48	1,25	99
733	14,48	1,25	99
734	14,49	1,25	100
735	14,49	1,25	100
736	14,49	1,25	100
737	14,49	1,25	100
738	14,49	1,25	100
739	14,49	1,24	100
740	14,49	1,24	100
741	14,49	1,24	100
742	14,49	1,24	100
743	14,49	1,24	100

Time (s)	Voltage (V)	Current (A)	Estimasi SOC (%)
744	14,49	1,22	100
745	14,49	1,22	100
746	14,49	1,23	100
747	14,49	1,22	100
748	14,49	1,22	100
749	14,49	1,22	100
750	14,49	1,22	100
751	14,49	1,20	100
752	14,49	1,21	100
753	14,49	1,21	100
754	14,49	1,21	100
755	14,49	1,21	100
756	14,49	1,21	100
757	14,49	1,21	100
758	14,49	0,76	100
759	14,49	0,76	100
760	14,49	0,63	100
761	14,50	0,56	100
762	14,50	0,56	100
763	14,50	0,56	100

LAMPIRAN II

KEMENTERIAN RISET,TEKNOLOGI DAN PENDIDIKAN TINGGI
POLITEKNIK NEGERI SRIWIJAYA
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Website : www.polisriwijaya.ac.id **E-mail :** info@polsri.ac.id

KESEPAKATAN BIMBINGAN LAPORAN AKHIR (LA)

Kami yang bertanda tangan di bawah ini,

Pihak Pertama

Nama	: Dinda Nurhalizah
NIM	: 062030320077
Jurusan	: Teknik Elektro
Program Studi	: D3-Teknik Elektronika

Pihak Kedua

Nama	: Selamat Muslimin, S.T.,M.Kom.
NIP	: 197907222008011007
Jurusan	: Teknik Elektro
Program Studi	: D3-Teknik Elektronika

Pada hari ini Kamis tanggal 02 Februari 2023 telah sepakat untuk melakukan konsultasi bimbingan Laporan Akhir.

Konsultasi bimbingan sekurang-kurangnya 3 (tiga) kali dalam satu minggu. Pelaksanaan bimbingan pada setiap hari Senin, Rabu, dan Jumat pukul 08.00-15.00 tempat di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Laporan Akhir.

Palembang, 02/02/2023

Pihak Pertama,

Dinda Nurhalizah
NIM.062030320077

Pihak Kedua,

Selamat Muslimin, S.T.,M.Kom.
NIP.197907222008011007

Mengetahui,
Ketua Jurusan

Ir. Iskandar Lutfi, M.T.
NIP.196501291991031002

KEMENTERIAN RISET,TEKNOLOGI DAN PENDIDIKAN TINGGI
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KESEPAKATAN BIMBINGAN LAPORAN AKHIR (LA)

Kami yang bertanda tangan di bawah ini,

Pihak Pertama

Nama	: Dinda Nurhalizah
NIM	: 062030320077
Jurusan	: Teknik Elektro
Program Studi	: D3-Teknik Elektronika

Pihak Kedua

Nama	: Ekawati Prihatini, S.T.,M.T.
NIP	: 197903102002122005
Jurusan	: Teknik Elektro
Program Studi	: D3-Teknik Elektronika

Pada hari ini Jumat tanggal 10 Februari 2023 telah sepakat untuk melakukan konsultasi bimbingan Laporan Akhir.

Konsultasi bimbingan sekurang-kurangnya 3 (tiga) kali dalam satu minggu. Pelaksanaan bimbingan pada setiap hari Senin, Rabu, dan Kamis pukul 08.00-15.00, tempat di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Laporan Akhir.

Palembang, 10 Februari 2023

Pihak Pertama,

Dinda Nurhalizah
NIM.062030320077

Pihak Kedua,

Ekawati Prihatini, S.T.,M.T.
NIP.197903102002122005

Mengetahui,
Ketua Jurusan

Ir. Iskandar Lutfi, M.T.
NIP.196504291991031002

No. Dok. : F-PBM-17 | Tgl. Berlaku : 13 Desember 2010 | No. Rev. : 00

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
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Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

LEMBAR BIMBINGAN LAPORAN AKHIR

Lembar : 1

Nama	:	Dinda Nurhalizah
NIM	:	062030320077
Jurusan/Program Studi	:	Teknik Elektro / D3 – Teknik Elektronika
Judul Laporan Akhir	:	Perancangan Algoritma *Ant Colony System* Pada Pengisian Baterai *Lead Acid* Mobil Listrik Berbasis Regresi Linier
Pembimbing I	:	Selamat Muslimin, S.T., M.Kom.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	31/01 23	Kelengkapan bimbingan LA.	[signature]
2.	6/02 23	Permasalahan pada ... - Charging, battery, kontrol.	[signature]
3.	19/09 23	Proposal LA - rumusan masalah. - tinjauan.	[signature]
4.	21/02 23	... diagram ... charging	[signature]
5.	20/03 23	Pendahuluan - rumusan - Charging. - tinjauan - ACO.	[signature]
6.	27/03 23	Proposal ..., disempurnakan.	[signature]
7.	18/4 23	Metode pengambilan data ... - ACO dan RL.	[signature]

No. Dok. : F-PBM-17 | Tgl. Berlaku : 13 Desember 2010 | No. Rev. : 00

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
8.	19/09 23	Perancangan Algoritma ACO	
9.	12/05 23	Hasil perbaikan Cheapest ACO.	
10.	26/05 23	Simulasi data, dan pengujian.	
11.	12/06 23	Hasil Bab 4, 5. Finish.	
12.	15/06 23	Perbaikan Revisi	

Palembang, 1 September 2023

Ketua ~~Jurusan~~/KPS,

(Dewi Permata Sari, S.T., M.Kom)
NIP 197612132000032001

Catatan:
*) melingkari angka yang sesuai
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

No. Dok : F-PBM-17 | Tgl. Berlaku : 13 Desember 2010 | No. Rev : 00

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
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LEMBAR BIMBINGAN LAPORAN AKHIR

Lembar : 1

Nama : Dinda Nurhalizah
NIM : 062030320077
Jurusan/Program Studi : Teknik Elektro / D3 – Teknik Elektronika
Judul Laporan Akhir : Perancangan Algoritma *Ant Colony System* Pada Pengisian Baterai *Lead Acid* Mobil Listrik Berbasis Regresi Linier
Pembimbing II : Ekawati Prihatini, S.T.,M.T.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	31 Januari 23	Pengajuan Kesepakatan Bimbingan LA	
2.	13 Februari 23	Pengajuan Topik Proposal LA	
3.	21 Februari 23	ACC Judul Proposal, Lanjut Bab I - III Proposal	
4.	15 Maret 23	Revisi Bab I & III, Metodologi	
5.	20 Maret 23	ACC Bab I, II, Revisi Flowchart	
6.	31 Maret 23	ACC Proposal LA	
7.	27 Juni 23	Bimbingan Prediktif tabel & Bab 4 & Analisa	

No. Dok. : F-PBM-17 Tgl. Berlaku : 13 Desember 2010 No. Rev. : 00

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
8.	17 Juli 23	Analisa Data Charging dgn algoritma & tanpa algoritma	
9.	24 Juli 23	Tabel & grafik perbandingan dgn & tanpa ACO	
10.	31 Juli 23	Tabel & grafik RMSE Machine Learning	
11.	01 Agustus 23	Revisi Bab IV, V, Lengkapi daftar2	
12.	02 Agustus 23	ACC Laporan LA, Rekomendasi Sidang LA.	

Palembang, 1 September 2023

~~Ketua Jurusan~~/KPS,

(Dewi Permata Sari, S.T., M.Kom.
NIP 197612132000032001

Catatan:
*) meiingkari angka yang sesuai.
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

KEMENTERIAN, PENDIDIKAN KEBUDAYAAN
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REKOMENDASI UJIAN LAPORAN AKHIR (LA)

Pembimbing Laporan Akhir memberikan rekomendasi kepada,

Nama	:	Dinda Nurhalizah
NIM	:	062030320077
Jurusan/Program Studi	:	Teknik Elektro / D3 – Teknik Elektronika
Judul Laporan Akhir	:	Perancangan Algoritma *Ant Colony System* Pada Pengisian Baterai *Lead Acid* Mobil Listrik Berbasis Regresi Linier

Mahasiswa tersebut telah memenuhi persyaratan dan dapat mengikuti Ujian Laporan Akhir (LA) pada Tahun Akademik 2022/2023.

Palembang, 4 Agustus 2023

Pembimbing I,

Selamat Muslimin, S.T.,M.Kom.
NIP. 197907222008011007

Pembimbing II,

3/8.23

Ekawati Prihatini, S.T.,M.T.
NIP. 197903102020022122005

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

PELAKSANAAN REVISI LAPORAN AKHIR

Mahasiswa berikut,

Nama	:	Dinda Nurhalizah
NIM	:	062030320077
Jurusan/Program Studi	:	Teknik Elektro / D3 – Teknik Elektronika
Judul Laporan Akhir	:	Penerapan Algoritma *Ant Colony System* Pada Pengisian Baterai *Lead Acid* Mobil Listrik Berbasis Regresi Linier

Telah melaksanakan revisi terhadap Laporan Akhir yang diujikan pada hari Senin tanggal 21 bulan Agustus tahun 2023. Pelaksanaan revisi terhadap Laporan Akhir tersebut telah disetujui oleh Dosen Penguji yang memberikan revisi:

No.	Komentar	Nama Dosen Penguji *)	Tanggal	Tanda Tangan
1.				
2.	Ok	Ir. Pola Risma	22/8 23	
3.	Acc	Fitroh Dewi	21/08 23	
4.	Acc	Selamat ya	22/8 23	

Palembang, 22 Agustus 2023

Ketua Penguji **)

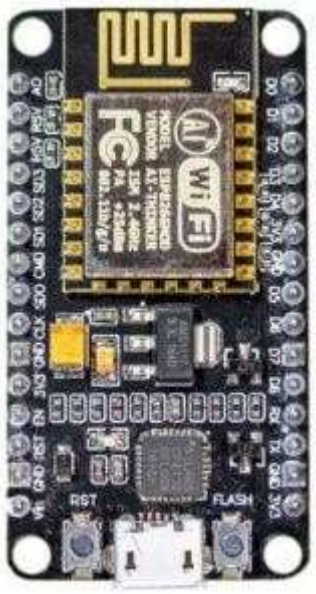
(Ir. Pola Risma, M.T.)

NIP 196303281990032001

Catatan:
*) Dosen penguji yang memberikan revisi saat ujian laporan akhir.
**) Dosen penguji yang ditugaskan sebagai Ketua Penguji saat ujian LA.
Lembaran pelaksanaan revisi ini harus ditampilkan dalam Laporan Akhir.

LAMPIRAN III

NODEMCU ESP8266



The NodeMCU (***N***ode ***M***icro***C***ontroller ***U***nit) is an open- source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware. This level of integration is not a problem using the ESP8266 as an embedded controller chip in mass-produced electronics. It is a huge burden for hobbyists, hackers, or students who want to experiment with it in their own IoT projects.

But, what about Arduino? The Arduino project created an open-source hardware design and software SDK for their versatile IoT controller. Similar to NodeMCU, the Arduino hardware is a microcontroller board with a USB connector, LED lights, and standard data pins. It also defines standard interfaces to interact with sensors or other boards. But unlike NodeMCU, the Arduino board can havedifferent types of CPU chips (typically an ARM or Intel x86 chip) with memory chips, and a variety of programming environments. There is an Arduino reference design for the ESP8266 chip as well. However, the flexibility of Arduino also means significant variations across different vendors. For example, most Arduino boards do not have WiFi capabilities, and some even have a serial data port instead of a USB port.

NodeMCU Specifications

The NodeMCU is available in various package styles. Common to all the designs is the base ESP8266 core. Designs based on the architecture have maintained the standard 30-pin layout. Some

designs use the more common narrow (0.9″) footprint, while others use a wide (1.1″) footprint – an important consideration to be aware of.

The most common models of the NodeMCU are the Amica (based on the standard narrow pin-spacing) and the LoLin which has the wider pin spacing and large

board. The open-source design of the base ESP8266 enables the market to designnew variants of the NodeMCU continually.

Official Amica NodeMCU

Amica NodeMCU measures 49mm x 26mm with a standard pin space of 0.1″between pins and 0.9″ between rows.

The Amica NodeMCU is approximately 25% smaller in size than a closelycompatible LoLin style NodeMCU

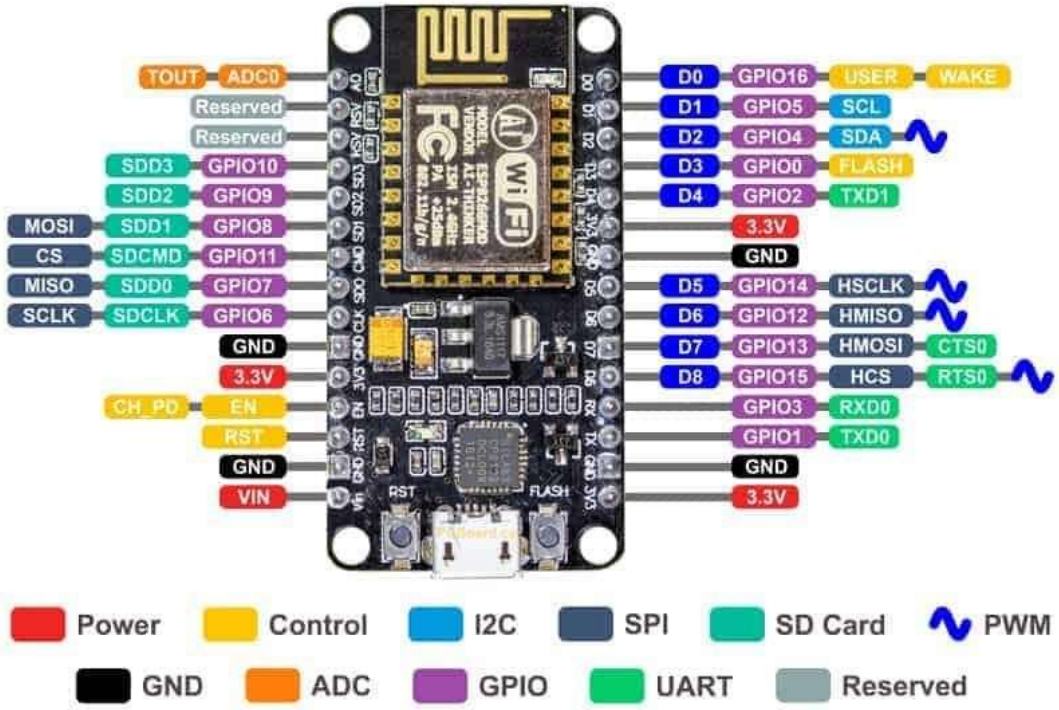
Official Amica NodeMCU on Carrier Board

Amico NodeMCU mounted to a 102mm x 51mm carrier board with dual DB-09male/female connectors

Lolin NodeMCU

LoLin style NodeMCU measures 58mm x 32mm with a pin spacing of 0.1″between pins and 1.1″ between rows

NodeMCU Pinout and Functions Explained



- Power Pins There are four power pins. **VIN** pin and three **3.3V** pins.
- **VIN** can be used to directly supply the NodeMCU/ESP8266 and its peripherals. Power delivered on **VIN** is regulated through the onboard regulator on the NodeMCU module – you can also supply 5V regulated to the **VIN** pin
- **3.3V** pins are the output of the onboard voltage regulator and can be used to supply power to external components.

- GND are the ground pins of NodeMCU/ESP8266

- I2C Pins are used to connect I2C sensors and peripherals. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.

- GPIO Pins NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to

internal pull-up or pull-down, or set to high impedance. When configured as aninput, it can also be set to edge-trigger or level-trigger to generate CPU interrupts.

- ADC Channel The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.

- UART Pins NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 & CTS0 pins) canbe used for communication. However, UART1 (TXD1 pin) features only data transmit signal so, it is usually used for printing log.

- SPI Pins NodeMCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features:
- 4 timing modes of the SPI format transfer
- Up to 80 MHz and the divided clocks of 80 MHz
- Up to 64-Byte FIFO

- SDIO Pins NodeMCU/ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.

- PWM Pins The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 µs to 10000 µs (100 Hz and 1 kHz).

- Control Pins are used to control the NodeMCU/ESP8266. These pins includeChip Enable pin (EN), Reset pin (RST) and WAKE pin.
- **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulledLOW the chip works at minimum power.
- **RST:** RST pin is used to reset the ESP8266 chip.
- **WAKE:** Wake pin is used to wake the chip from deep-sleep.

-  Control Pins are used to control the NodeMCU/ESP8266. These pinsinclude Chip Enable pin (EN), Reset pin (RST) and WAKE pin.
- **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH.

PZEM-003/017 DC communication module

Overview

This document describes the specification of the PZEM-003/017 DC communication module, the module is mainly used for measuring DC voltage, current, active power, frequency and energy consumption, the module is without display function, the data is read through the RS485 interface.

PZEM-003: Measuring Range 10A (Built-in Shunt)

PZEM-017: Measuring Range 50A、100A、200A、300A (the current range is depend on theexternal shunt specification)

1. Function description

1.1 Voltage

1.1.1 Measuring range:0.05-300V. (when the test voltage is ＜ 7V, please use theindependent power supply mode)

1.1.2 Resolution:0.01V.

1.1.3 Measurement accuracy:1%.

1.2 Current

1.2.1 Measuring range:0.01-10A(PZEM-003);0.02-300A(PZEM-017;can be matched with50、100、200、300A four kinds of shunt).

1.2.2 Resolution:0.01A

1.2.3 Measurement accuracy:1%

1.3 Power

1.3.1 Measuring range:0.1-3kW(PZEM-003);0.2-90kW(PZEM-017)

1.3.2 Resolution: 0.1W

1.3.3 Measurement accuracy:1%

1.4 Energy Consumption

1.4.1 Measuring range: 0-9999kWh

1.4.2 Resolution: 1Wh

1.4.3 Measurement accuracy:1%

1.4.4 Reset energy: use software to reset.

1.5 Over Voltage alarm

Voltage threshold can be set, divide into high voltage and low voltage threshold, when the measured voltage exceeds the threshold, it can alarm

The default high voltage threshold is 300V, the default low voltage threshold is 7V.

1.6 Communication interface

RS485 interface.

2. Communication protocol

2.1 Physical layer protocol

Physical layer use UART to RS485 communication

interface.Baud rate is 9600, 8 data bits, 2 stop bit,

no parity.

2.2 Application layer protocol

The application layer use the Modbus-RTU protocol to communicate. At present, it only supports function codes such as 0x03 (Read Holding Register), 0x04 (Read Input Register), 0x06 (Write Single Register), 0x41 (Calibration), 0x42 (Reset energy).etc.

0x41 function code is only for internal use (address can be only 0xF8), used for factory calibration and return to factory maintenance occasions, after the function code to increase 16-bit password, the default password is 0x3721.

The address range of the slave is 0x01 ~ 0xF7. The address 0x00 is used as the broadcast address, the slave does not need to reply the master. The address 0xF8 is used as the general address, this address can be only used in single-slave environment and can be used for calibration etc.operation.

2.3 Read the measurement result

The command format of the master reads the measurement result is(total of 8 bytes):

Slave Address + 0x04 + Register Address High Byte + Register Address Low Byte + Numberof Registers High Byte + Number of Registers Low Byte + CRC Check High Byte + CRC Check Low Byte.

The command format of the reply from the slave is divided into two kinds:

Correct Reply: Slave Address + 0x04 + Number of Bytes + Register 1 Data High Byte +Register 1 Data Low Byte + ... + CRC Check High Byte + CRC Check Low Byte

Error Reply: Slave address + 0x84 + Abnormal code + CRC check high byte + CRC checklow byte

Abnormal code analyzed as following (the same below)

- 0x01,Illegal function;
- 0x02,Illegal address;
- 0x03,Illegal data;
- 0x04,Slave error.

The register of the measurement results is arranged as the following table

Register address	Description	Resolution
0x0000	Voltage value	1LSB correspond to 0.01V
0x0001	Current value	1LSB correspond to 0.01A
0x0002	Power value low 16 bits	1LSB correspond to 0.1W
0x0003	Power value high 16 bits	
0x0004	Energy value low 16 bits	1LSB correspond to 1Wh
0x0005	Energy value high 16 bits	
0x0006	High voltage alarm status	0xFFFF is alarm,0x0000 is not alarm
0x0007	Low voltage alarm status	0xFFFF is alarm,0x0000 is not alarm

For example, the master sends the following command (CRC check code is replaced by0xHH and 0xLL, the same below):

0x01 + 0x04 + 0x00 + 0x00 + 0x00 + 0x08 + 0xHH + 0xLL

Indicates that the master needs to read 8 registers with slave address 0x01 and the startaddress of the register is 0x0000.

The correct reply from the slave is as following:

0x01 + 0x04 + 0x10 + 0x27 + 0x10 + 0x00 + 0x64 + 0x03 + 0xE8 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0xHH + 0xLL

The above data shows

- Voltage is 0x2710，converted to decimal is 10000,display 100.00V；
- Current is 0x0064，converted to decimal is 100,display 1.00A；
- Power is 0x000003E8，converted to decimal is 1000,display 100.0W；
- Energy is 0x00000000，converted to decimal is 0,display 0Wh；
- High voltage alarm status 0x0000,indicates the current voltage is lower than the highvoltage threshold.
- Low voltage alarm status 0x0000,indicates the current voltage is higher than the lowvoltage threshold.

2.4 Read and modify the slave parameters

At present,it only supports reading and modifying slave address and power alarm thresholdThe register is arranged as the following table

0x0001	Low voltage alarm threshold （1~350V）,default is 7V	1LSB correspond to 0.01V
0x0002	Modbus-RTU address	The range is 0x0001~0x00F7
0x0003	The current range(only for PZEM-017)	0x0000：100A 0x0001：50A 0x0002：200A 0x0003：300A

The command format of the master to read the slave parameters and read the measurement results are same(described in details in Section 2.3), only need to change the function code from0x04 to 0x03.

The command format of the master to modify the slave parameters is (total of 8 bytes):

Slave Address + 0x06 + Register Address High Byte + Register Address Low Byte + RegisterValue High Byte + Register Value Low Byte + CRC Check High Byte + CRC Check Low Byte.

The command format of the reply from the slave is divided into two kinds:

Correct Response: Slave Address + 0x06 + Number of Bytes + Register Address Low Byte + Register Value High Byte + Register Value Low Byte + CRC Check High Byte + CRC Check LowByte.

Error Reply: Slave address + 0x86 + Abnormal code + CRC check high byte + CRC checklow byte.

For example, the master sets the slave's high voltage

alarm threshold:0x01 + 0x06 + 0x00 + 0x00 + 0x4E +

0x20 + 0xHH + 0xLL

Indicates that the master needs to set the 0x0000 register (high voltage alarm threshold) to0x4E20（200.00V）.

Set up correctly, the slave return to the data which is sent

from the master.For example, the master sets the low

voltage alarm threshold of the slave 0x01 + 0x06 + 0x00 +

0x01 + 0x03 + 0xE8 + 0xHH + 0xLL

Indicates that the master needs to set the 0x0001 register (low voltage alarm threshold) to0x03E8(10.00V).

Set up correctly, the slave return to the data which is sent

from the master.For example, the master sets the address of

the slave

0x01 + 0x06 + 0x00 + 0x02 + 0x00 + 0x05 + 0xHH + 0xLL

Indicates that the master needs to set the 0x0002 register (Modbus-RTU

address) to 0x0005Set up correctly, the slave return to the data which is sent

from the master.

The command format of the master to reset the slave's

energy is (total 4 bytes):Slave address + 0x42 + CRC

check high byte + CRC check low byte.

Correct reply: slave address + 0x42 + CRC check high byte + CRC check low byte.

Error Reply: Slave address + 0xC2 + Abnormal code + CRC check high byte + CRC checklow byte

2.5 Calibration

The command format of the master to calibrate the

slave is (total 6 bytes): 0xF8 + 0x41 + 0x37 + 0x21 + CRC

check high byte + CRC check low byte.

Correct reply: 0xF8 + 0x41 + 0x37 + 0x21 + CRC check high byte + CRC check low byte.

Error Reply: 0xF8 + 0xC1 + Abnormal code + CRC check high byte + CRC check low byte.

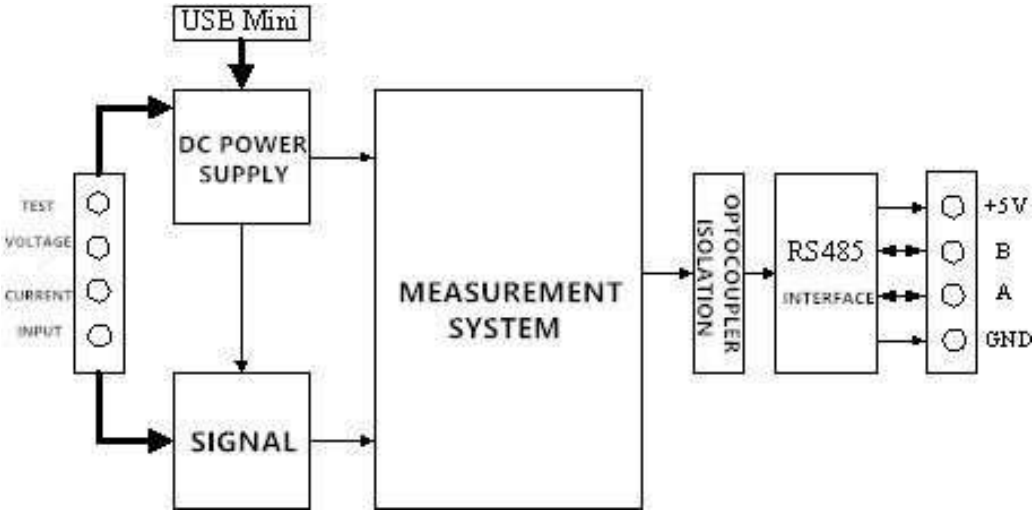
It should be noted that the calibration takes 3 to 4 seconds, after the master sends the command, if the calibration is successful, it will take 3 ~ 4 seconds to receive the response fromthe slave.

2.6 CRC check

CRC check use 16bits format, occupy two bytes, the generator polynomial is X16 + X15 +X2 +1, the polynomial value used for calculation is 0xA001.

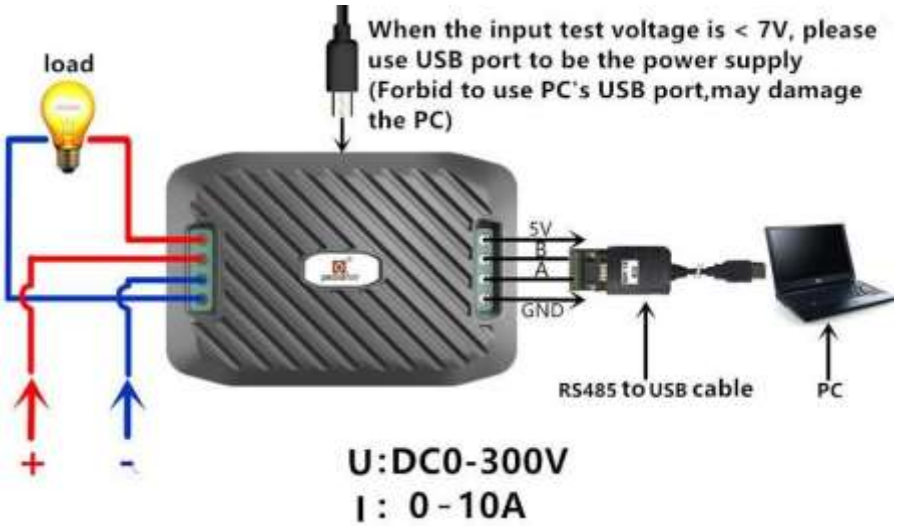
The value of the CRC check is all results of a frame data checking divide CRC

3. Functional block diagram

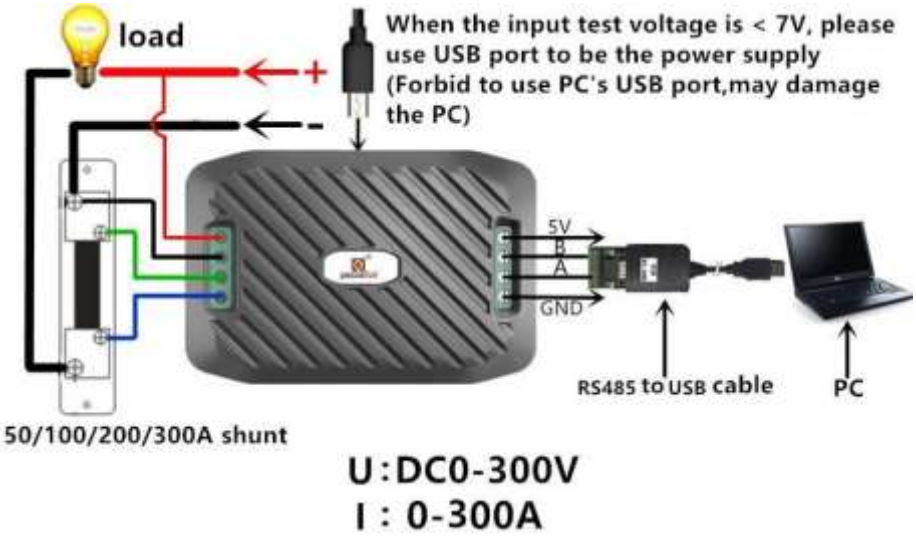


Picture 3 Functional block diagram

4.Wiring diagram



Picture 4.1 PZEM-003Wiring diagram



Picture 4.2 PZEM-017 Wiring diagram

5. Other instructions

5.1 RS485 interface is passive output, need external connect 5V power supply and the theexternal power supply should ＞100mA.

5.2 When the input test voltage is less than 7V, it must supply 5V independent work voltagethrough MICRO USB port；