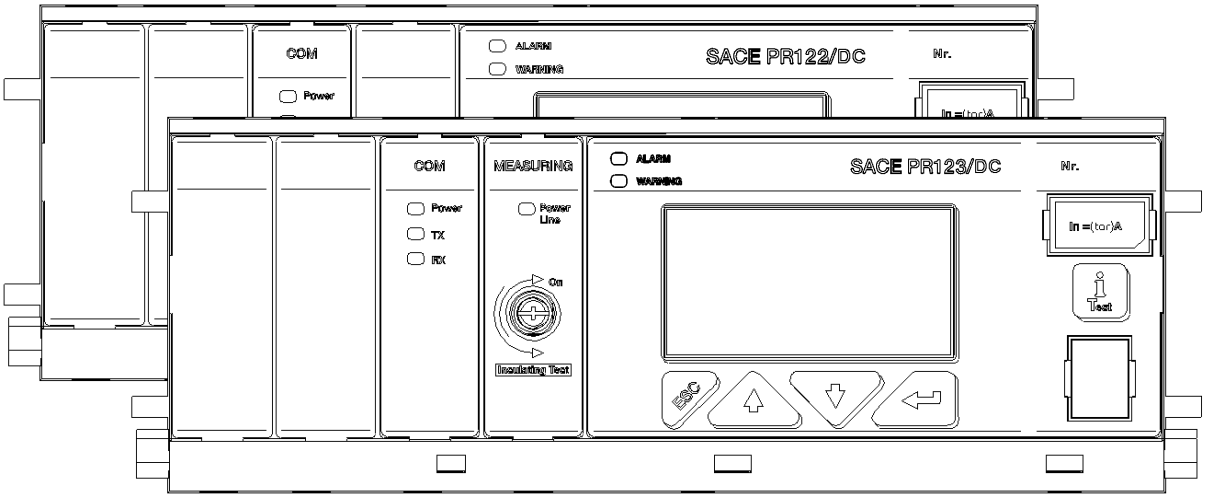
1SDH000841R0001	L6143

Communication System Interface

Communication System Interface for protection trip units PR122DC and PR123DC + PR120/D-M Com module



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1. REVISION HISTORY

1.1 Rev 01, 11/01/2011

First release.

1.2 Rev 02, 04/04/2014

Added UL CBs to table TAB_CB_TYPE.
Added UL Product Standard Reference (register 702).
Valid from SW version 3.01.
Corrected command example (par.8.1).

2. AIM

The aim of this document is to indicate all the information and commands available with protection units PR122DC / PR123DC and module PR120/D-M.
Moreover, it explains the procedures to read information and to program the parameters of the above mentioned protection units, in Modbus RTU Standard.

3. ACRONYMS AND DEFINITIONS

3.1 Acronyms

AI	Analog Input
AO	Analog Output
CB	Circuit Breaker
LSb	Least Significant Bit
MSb	Most Significant Bit
LSB	Least Significant Byte
MSB	Most Significant Byte

BOOL	Bit or Boolean (IEC 61131-3)
BYTE	Byte (IEC 61131-3)
WORD	Word (IEC 61131-3)
DWORD	Double word (IEC 61131-3)
LWORD	Long Word (IEC 61131-3)
SINT	Short Integer (IEC 61131-3)
USINT	Unsigned Short Integer (IEC 61131-3)
INT	Single Integer (IEC 61131-3)
UINT	Unsigned Integer (IEC 61131-3)
DINT	Double Integer (IEC 61131-3)
UDINT	Unsigned Double Integer (IEC 61131-3)
LINT	Long Integer (IEC 61131-3)
ULINT	Unsigned Long Integer (IEC 61131-3)
STRING	Text String (IEC 61131-3)
UNICODE	Unicode (IEC 61131-3)

4. Communication parameters

Serial type	Baud rate	Address	Addressing type	Physical protocol
SSI	500 KHz	3	Standard	E, 8, 1
Bus EXT	9600/19200 bit/s	1 ÷ 247	Standard / ABB	E, 8, 1 O, 8, 1 N, 8, 2 N, 8, 1
Bus INT	19200 bit/s	3	Standard	E, 8, 1
Bus Test	19200 bit/s	3	Standard	E, 8, 1

5. Unit identification

Unit	Slave ID
PR123DC	0x58
PR122DC	0x59

6. Available Modbus functions

Function Code		Nome	Applicabile a
03 (03h)		Read Holding Registers	AO
04 (04h)		Read Input Registers	AI
06 (06h)		Write Single Register	AO
Funct Code	**Subf Code**	**Nome**	**Applicabile a**
08 (08h)	00 (00H)	Diagnostic Loopback	---
Function Code		**Nome**	**Applicabile a**
16 (10h)		Write Multiple Registers	AO
17 (11h)		Report Slave ID	---
70 (46h)		Read Extended Registers	Extended Reg

Nota 1. All queries must respect the limitation of the maximum modbus message length of 256 byte

Legend:
AA = slave address (1 247)
cl = byte low of CRC
ch = byte high of CRC

6.1 Function 03 (03h) Read Holding Registers

Query

Addr	Function	Starting address		Number of registers		Crc	
AA	03h	High	Low	High	Low	ch	cl

Nota 1. Number of registers ≤ 125

Response

Addr	Function	Byte count	Register value		…	Register value		Crc	
AA	03h	nn	High	Low	…	High	Low	ch	cl

6.2 Function 04 (04h) Read Input Registers

Query

Addr	Function	Starting address		Nr of input registers		Crc	
AA	04h	High	Low	High	Low	ch	cl

Nota 1. Number of registers ≤ 125

Response

Addr	Function	Byte count	Input register		…	Input register		Crc	
AA	04h	nn	High	Low	…	High	Low	ch	cl

6.3 Function 06 (06h) Write Single Register

Query

Addr	Function	Register address		Register value		Crc	
AA	06h	High	Low	High	Low	ch	cl

Response (echo della query)

Addr	Function	Register address		Register value		Crc	
AA	06h	High	Low	High	Low	ch	cl

6.4 Function 08 (08h) Diagnostic

Query

Addr	Function	Subfunction		Data	…	Crc	
Aa	08h	00h	00h	yy	…	ch	cl

Nota 1. 0 ≤ Number of data bytes ≤ 250, any value

Response (echo della query)

Addr	Function	Subfunction		Data	…	Crc	
Aa	08h	00h	00h	yy	…	ch	cl

6.5 Function 16 (10h) Write Multiple Registers

Query

Addr	Funct	Starting addr		Num of registers		Byte count	Reg value		…	Reg value		Crc	
Aa	10h	High	Low	High	Low	Nn	High	Low	…	High	Low	ch	cl

Nota 1. Number of registers ≤ 123

Response

Addr	Function	Starting address		Number of register		Crc	
Aa	10h	High	Low	High	Low	ch	cl

Nota 2. Number of registers ≤ 123

6.6 Function 17 (11h) Report slave ID

Query

Addr	Function	Crc	
AA	11h	ch	cl

Response

Addr	Function	Byte count	Slave ID	Run indicator	Sw Version		Addr eventi		Device Ser Nr	Crc	
AA	11h	16h	ID	0FFh	High	Low	High	Low	16 byte (ASCII)	ch	cl

6.7 Function 70 (46h) Read Extended Registers

Query

Addr	Function	Byte count	Ref type	File number		Starting address		Number of registers		Crc	
AA	46h	07h	06h	High	Low	High	Low	High	Low	ch	cl

Nota 1. File number ≤ 3

Nota 2. Starting address ≤ 65535

Nota 3. Number of registers ≤ 125

Response

Addr	Funct	Byte count	Ref type	Reg value		…	Reg value		Crc	
AA	46h	Nn	06h	High	Low	…	High	Low	ch	cl

6.8 Exception responses

6.8.1 Illegal function

Addr	Function	Exception code	Crc	
AA	Function + 80h	01h	ch	cl

6.8.2 Illegal data address

Addr	Function	Exception code	Crc	
AA	Function + 80h	02h	ch	cl

6.8.3 Illegal data value

Addr	Function	Exception code	Crc	
AA	Function + 80h	03h	ch	cl

6.8.4 Slave device failure

Addr	Function	Exception code	Crc	
AA	Function + 80h	04h	ch	cl

6.8.5 Slave device busy

Addr	Function	Exception code	Crc	
AA	Function + 80h	06h	ch	cl

6.8.6 Exception occurrences

		ECCEZIONI				
		01 Illegal function	02 Illegal data address	03 Illegal data value	04 Slave device failure	06 Slave device busy
FUNCTION DELLA QUERY	03		• Starting address not valid	• Invalid query length • Requested no. of register too large • Address out of modbus map		
	04		• Starting address not valid	• Invalid query length • Requested no. Of register too large • Address out of modbus map		• Reading attempt in flash with flash busy
	06		• Starting address not valid • Write of a time information not allowed with this function	• Invalid query length		• Reading from ext bus in local mode • Programming session already open on the other bus • Programming session not open
	08			• Subfunction ≠ 00 00 • Invalid query length		
	16		• Starting address not valid	• Invalid query length • Requested no. of register too large • Address out of modbus map • Not provided command • Invalid command parameter • Wrong time	• Parameters error check after a stop programming session command	• Reading from ext bus in local mode • Programming session not open • Programmins session already open on other bus • Command acceptance conditions not verified
	17			• Invalid query length		
	70		• Starting address not valid	• Invalid query length • No. of registers too large • Invalid Address out of map Field Ref Type • Invalid Field Byte count		• Reading attempt of busy datalogger

7. MODBUS MAP

Data format LINT (4 byte = 2 word = 2 registers) is transferred with low significant part at lower modbus address (LOW-HIGH)

Register i	LS word
Register i + 1	MS word

Instead within WORD data the most significant byte is transferred first (as in MODBUS RTU standard)

MS byte	LS byte

7.1 MEASURES

The following table shows the available measures for each type of device and possible necessary conditions:

	PR122DC	PR123DC
Line Currents	✳	✳
Internal ground current		✳
Voltage		✳
Power		✳
Energy		✳
Trip history	✳	✳
Log event history	✳	✳
Measure history	✳	✳
Contact wear	✳	✳
Datalogger	✳	✳

Legend ✳: Available without further conditions

7.2 PROTECTIONS

The following table shows the different available protections for each type of device and possible necessary conditions:

	PR122DC	PR123DC
L	✳	✳
S	✳	✳
S2		✳
I	✳	✳
G		✳
U		✳
UV		✳
OV		✳
RP		✳
OT	✳	✳
LC	✳(1)	✳(1)
Hw prot.	✳	✳

Legend ✳: Available without further conditions

(1): Load control always enabled on state bits but feasible only if present signaling module or output unit on system bus (ex: PR120/K)

7.3 REGISTER MAP

7.3.1 SYSTEM BUS MAP

Ind rel	AI [30001]	AO [40001]			
	Function 4 (Error! Reference source not found.)	Function:	16 (Error! Reference source not found.)	3 (Error! Reference source not found.)	6 (Error! Reference source not found.)
0	DATI STATISTICI (8.2)	COMM(8.1)			
50	PROGR FAIL ERROR CODE (8.3)				
100	STATE(8.4)	TIME(8.5) (*)			
200	RUN TIME MEASURES (8.5)				
600	(8.7)				
700	INFORMATION(8.7)				
1000	***PAR. CONFIG1 ACTUAL(8.8)***				
1020	***PAR. CONFIG2 ACTUAL(8.9)***				
1050	***PAR. CONFIG3 ACTUAL(8.10**Error! Reference source not found.**)***	PAR. CONFIG3 NEW (*)			
1100	***PAR. PROT. SET1 ACTUAL (8.11)***	PAR. PROT SET1 NEW (*)			
1200	***PAR. PROT. SET2 ACTUAL (8.11)***	PAR. PROT SET2 NEW (*)			
2000	***STORICO DATI DI TRIP (8.12)***				
2500	***STORICO MISURE (8.13)***				
3300	***LOG EVENTI (0)***				
6000					

⚠ ***FLASH*** : could be busy (busy exception response)

(*) Parameters that can be written only during an open programming session

Example of table reading:

RUN-TIME MEASURES analog input absolute address: 30001+offset (200) = 30201

The relative address is offset (200) = 200

7.4 DATALOGGER MAP (extended registers)

⚠ Addressing type "ABB" cannot be used for these registers, therefore the address field will be always included between 1 and 65536 for all addressing methods.

File Number	Sample Number	*Extended Reg (600000)*			*PR12x*
		Function 70			
		Ind relativo	Description	Note	
File 0 (Old)	Samples 0 (Old)	0	Current sample IA	Note 1	2/3
		1	Current sample IA2	Note 1	2/3
		2	Current sample IB	Note 1	3
		3	Current sample IB2	Note 1	3
		4	---		
		5	Current sample IA MSP	Note 2	2/3
		6	Current sample IA2 MSP	Note 2	2/3
		7	Current sample IB MSP	Note 2	3
		8	Current sample IB2 MSP	Note 2	3
		9	---		
		10	---		
		11	Voltage sample	Note 3	2/3
		12	Input/Output status	TAB_INPUT_OUTPUT	2/3
		13	Allarms 1 status	TAB_ALARM_1	2/3
		14	Allarm 2 status	TAB_ALARM_2	2/3
		15	Trip 1 status	TAB_TRIP	2/3
	Samples 1	16 ÷ 31	"	"	2/3
	…	…	"	"	2/3
	Samples 4095 (New)	65519 ÷ 65535	"	"	2/3
File 1	Samples 0 ÷ Samples 4095	0 ÷ 65535	"	"	2/3
File 2	Samples 0 ÷ Samples 4095	0 ÷ 65535	"	"	2/3
File 3 (New)	Samples 0 ÷ Samples 4095	0 ÷ 65535	"	"	2/3

Note 1: Signal sample with 1365 → 1 In

Note 2: Signal sample with:

Shunt = 8 μΩ → 1 = 106,1776 A

Shunt = 15 μΩ → 1 = 199,083 A

Shunt = 20 μΩ → 1 = 265,444 A

Note 3: Signal sample with 750 rms → 71,04 Vrms

Table 1 TAB_INPUT_OUTPUT

Bit	Input type
0	Local bus Relè 1 contact
1	Local bus Relè 2 contact
2	Local bus Relè 3 contact
3	Local bus Relè 4 contact
4	---
5	Local bus Relè 6 contact
6	Local bus Relè 7 contact
7	Local bus Relè 8 contact
8	Relè P1 contact
9	Relè P2 contact
10	Relè P3 contact
11	Relè P4 contact
12	S zone selectivity input
13	S zone selectivity output
14	G zone selectivity input
15	G zone selectivity output

Table 2 TAB_TRIP

Bit	Input type
0	L tripped
1	S tripped
2	S2 tripped
3	I tripped
4	Iinst tripped
5	G tripped
6	---
7	OT tripped
8	---
9	U tripped
10	UV tripped
11	OV tripped
12	---
13	RP tripped
14	---
15	---

Table 3 TAB_ALARM_1

Bit	Input type
0	---
1	Contact Wear Pre-alarm
2	Contact Wear Alarm
3	L Pre-alarm
4	L Timing
5	S Timing
6	S2 Timing
7	G Timing
8	G Alarm (Blocked Trip)
9	---
10	---
11	OT Pre-alarm
12	OT Alarm
13	OT Alarm (Blocked Trip)
14	---
15	U Timing

Table 4 TAB_ALARM_2

Bit	Input type
0	U Alarm (Blocked Trip)
1	UV Timing
2	UV Alarm (Blocked Trip)
3	OV Timing
4	OV Alarm (Blocked Trip)
5	---
6	---
7	RP Timing
8	RP Alarm (Blocked Trip)
9	---
10	---
11	---
12	---
13	---
14	Iw Warning
15	LC1 Alarm

8. DESCRIPTION OF REGISTERS

8.1 COMMANDS

Rel addr	*# of item*	*Nome*	*Formula di conversione*	*Bus*
0	1	COMMAND TYPE	TAB_COMMANDS	SLTI
1	1	COMMAND PARAMETER	TAB_COMMANDS	SLTI

To execute a command it is requested to write to COMMAND TYPE field the number desired and in the following address the possible parameter related to the command.
To send a command it is requested to use function 16 and write both the command registers and the parameter also if this one is not necessary.

Example: to send the command "Trip reset", write 01 at the address of the register COMMAND TYPE and 00 at the address of the PARAMETER address (parameter not necessary for this command).

Following the command list table with pertinent command parameters.

Table 5 TAB_COMMANDS

Value	Command type	Parameter	*PR12x*
0	Dummy command	don't care	2-3
1	Trip reset	don't care	2-3
2	Signaling Reset	don't care	2-3
3	Communication statistics reset	don't care	2-3
4	Log event reset	don't care	2-3
5	Start programming session	don't care	2-3
6	Abort programming session	don't care	2-3
7	Stop programming session	don't care	2-3
8	CB Open	don't care	2-3
9	CB Close	don't care	2-3
10	CB Reset	don't care	2-3
11	Wink toggle command	don't care	2-3
12	History measure reset	don't care	2-3
13	History Energy reset	don't care	3
14	Datalogger trigger restart	don't care	2-3
15	Datalogger stop	don't care	2-3

8.2 STATISTICAL DATA

Rel addr	*# of item*	*Name*	*Representation*	*Notes*	*PR12x*
0	1	Received message number	0 ÷ 65535	Received msg no. = Received msg no. with crc error + Sent msg no. + Received broadcast msg no.	2-3
1	1	Received message number with crc error	0 ÷ 65535		2-3
2	1	Sent message number	0 ÷ 65535	Total exception response number included	2-3
3	1	Slave Busy exception number responses	0 ÷ 65535		2-3
4	1	Total exception response number	0 ÷ 65535	Slave Busy exception number response included	2-3
5	1	Contact wear	0 ÷ 65000 (100% = 65000) CW > 100% → 65000		2-3
6	1	Total trip protection number	0 ÷ 65535	Protection trip fail number included	2-3
7	1	Total operation number	0 ÷ 65535	Total operation no. = Manual operation no. + protection trip no. + protection trip fail no. + N° trip test no.	2-3
8	1	Manual operation number	0 ÷ 65535		2-3
9	1	Total trip protection number	0 ÷ 65535	Protection trip fail number not included	2-3
10	1	Trip protection fail number	0 ÷ 65535		2-3
11	1	Trip test number	0 ÷ 65535		2-3

⚠ Registers from address 0 to 4 compose the communication statistics, registers from address 6 to 11 compose CB operation statistics.

8.3 PROGR FAIL ERROR CODE

Rel addr	*# of item*	*Name*	*Notes*
50	1	Programming Fail Error Code	**0:** No error **1 ÷ 999:** Vedi tabella TAB_PAR_ERR_CODE Incongruency on **SET 1** **1001:** L Th ≥ S Th **1002:** S Th ≥ I Th **1003:** L Th ≥ S2 Th(PR123DC) **1004:** S2 Th ≥ I Th (PR123DC) Incongruency on **SET 2**: **2001:** L Th ≥ S Th **2002:** S Th ≥ I Th **2003:** L Th ≥ S2 Th **2004:** S2 Th ≥ I Th Common: **3001:** Error on the change language

Table 6 TAB_PAR_ERR_CODE

Par error code			Parameters address
< min	> max	Step err	
0	1	2	Not used
3	4	5	1020
6	7	8	1050
9	10	11	1301
12	13	14	1021
15	16	17	1022
18	19	20	1023
21	22	23	1024
24	25	26	1025
27	28	29	1026
30	31	32	1051
33	34	35	1083
36	37	38	1302
39	40	41	1303
42	43	44	1304
45	46	47	1305
48	49	50	1306
51	52	53	1307
54	55	56	1308
57	58	59	1309
60	61	62	1028
63	64	65	1029
66	67	68	1030
69	70	71	1031
72	73	74	1095
75	76	77	1096
78	79	80	1084
81	82	83	1085
84	85	86	1086
87	88	89	1087
90	91	92	1088
93	94	95	1089
96	97	98	1090
99	100	101	1091
102	103	104	1092
105	106	107	1093
108	109	110	1027
111	112	113	1094
114	115	116	1032
117	118	119	1097
120	121	122	1098
123	124	125	1052
126	127	128	1067
129	130	131	1053
132	133	134	1054
135	136	137	1055
138	139	140	1056
141	142	143	1057
144	145	146	1058
147	148	149	1059
150	151	152	1060
153	154	155	1061
156	157	158	1062
159	160	161	1063
162	163	164	1064
165	166	167	1065
168	169	170	1066
171	172	173	1068
174	175	176	1069
177	178	179	1070
180	181	182	1071

Par error code			Parameters address
< min	> max	Step err	
183	184	185	1072
186	187	188	1073
189	190	191	1074
192	193	194	1075
195	196	197	1076
198	199	200	1077
201	202	203	1078
204	205	206	1079
207	208	209	1080
210	211	212	1081
213	214	215	1082
216	217	218	1300
219	220	221	1314
222	223	224	1310
225	226	227	Not used
228	229	230	Not used
231	232	233	1311
234	235	236	1312
237	238	239	1313
240	241	242	1100
243	244	245	1101
246	247	248	1102
249	250	251	1104
252	253	254	1103
255	256	257	1105
258	259	260	1106
261	262	263	1107
264	265	266	1108
267	268	269	1110
270	271	272	1112
273	274	275	1109
276	277	278	1111
279	280	281	1113
282	283	284	1114
285	286	287	1115
288	289	290	1116
291	292	293	1118
294	295	296	1117
297	298	299	1119
300	301	302	1120
303	304	305	1121
306	307	308	1122
309	310	311	1125
312	313	314	1123
315	316	317	1124
318	319	320	1126
321	322	323	1127
324	325	326	1128
327	328	329	1129
330	331	332	1130
333	334	335	1131
336	337	338	1132
339	340	341	1133
342	343	344	1134
345	346	347	1136
348	349	350	1138
351	352	353	1135
354	355	356	1137
357	358	359	1139
360	361	362	1140
363	364	365	1141

Par error code			Parameters address
< min	> max	Step err	
366	367	368	1142
369	370	371	1143
372	373	374	1145
375	376	377	1147
378	379	380	1144
381	382	383	1146
384	385	386	1148
387	388	389	1149
390	391	392	1176
393	394	395	1177
396	397	398	1178
399	400	401	1150
402	403	404	1151
405	406	407	1152
408	409	410	1153
411	412	413	1154
414	415	416	1155
417	418	419	1156
420	421	422	1157
423	424	425	1158
426	427	428	1159
429	430	431	1160
432	433	434	1161
435	436	437	1162
438	439	440	1163
441	442	443	1164
444	445	446	1165
447	448	449	1166
450	451	452	1167
453	454	455	1168
456	457	458	1169
459	460	461	1170
462	463	464	1171
465	466	467	1172
468	469	470	1173
471	472	473	1174
474	475	476	1175
477	478	479	1179
480	481	482	1180
483	484	485	1181
486	487	488	1200
489	490	491	1201
492	493	494	1202
495	496	497	1204
498	499	500	1203
501	502	503	1205
504	505	506	1206
507	508	509	1207
510	511	512	1208
513	514	515	1210
516	517	518	1212
519	520	521	1209
522	523	524	1211
525	526	527	1213
528	529	530	1214
531	532	533	1215
534	535	536	1216
537	538	539	1218
540	541	542	1217
543	544	545	1219
546	547	548	1220

Par error code			Parameters address
< min	> max	Step err	
549	550	551	1221
552	553	554	1222
555	556	557	1225
558	559	560	1223
561	562	563	1224
564	565	566	1226
567	568	569	1227
570	571	572	1228
573	574	575	1229
576	577	578	1230
579	580	581	1231
582	583	584	1232
585	586	587	1233
588	589	590	1234
591	592	593	1236
594	595	596	1238
597	598	599	1235
600	601	602	1237
603	604	605	1239
606	607	608	1240
609	610	611	1241
612	613	614	1242
615	616	617	1243
618	619	620	1245
621	622	623	1247
624	625	626	1244
627	628	629	1246
630	631	632	1248
633	634	635	1249
636	637	638	1276
639	640	641	1277
642	643	644	1278
645	646	647	1250
648	649	650	1251
651	652	653	1252
654	655	656	1253
657	658	659	1254
660	661	662	1255
663	664	665	1256
666	667	668	1257
669	670	671	1258
672	673	674	1259
675	676	677	1260
678	679	680	1261
681	682	683	1262
684	685	686	1263
687	688	689	1264
690	691	692	1265
693	694	695	1266
696	697	698	1267
699	700	701	1268
702	703	704	1269
705	706	707	1270
708	709	710	1271
711	712	713	1272
714	715	716	1273
717	718	719	1274
720	721	722	1275
723	724	725	1279
726	727	728	1280
729	730	731	1281

8.4 STATE

Symbols (↑) and (↕) marks state bits whose variation are traced in the events log; (↑) means that variation from o to 1 is traced, instead (↕) means that variations from 0 to 1 and from 1 to 0 are traced too.

Rel addr	*# of item*	*Name*	*Bit*	*Description*	*Notes*	*PR12x*
100	1	STATE 1 GLITCH Note 4	BIT 0 (↑)	Parameter changed	1 = Parameter(s) changed	2-3
			BIT 1	Historical Measure Update	1 = Histor meas updated	2-3
			BIT 2	---	---	
			BIT 3 (↑)	Signalling Reset	1 = Signalling resetted	2-3
			BIT 4	Trip Reset	1 = Trip Reset Command executed	2-3
			BIT 5	CB Reset	1 = CB Reset Command executed	2-3
			BIT 6	Dummy Command	1 = Dummy Command executed	2-3
			BIT 7	Energy Reset	1 = Energy Reset command executed	3
			BIT 8	Dual Set Change	1 = Dual Set Changed	3
			BIT 9	---	---	
			BIT 10	---	---	
			BIT 11	---	---	
			BIT 12	---	---	
			BIT 13	---	---	
			BIT 14	---	---	
			BIT 15	---	---	
101	1	STATE 2 FLAGS	BIT 0	Any Alarm / Timing / Warning	OR of alarms	2-3
			BIT 1	Any Trip	OR of Trips (latched)	2-3
			BIT 2	CB tripped	1 = CB tripped	2-3
			BIT 3 (↕)	CB connected / isolated	0 = Isolated, 1 = Connected	2-3
			BIT 4 (↕)	CB open/closed	0 = Open, 1 = Closed	2-3
			BIT 5 (↕)	CB undefined	1 = Undefined	2-3
			BIT 6 (↕)	No communic on Local Bus	1 = No communication on LB	2-3
			BIT 7	Springs charged/discharged	0 = Discharged, 1 = Charged	2-3
			BIT 8 (↑)	Trip command fail	1 = Trip command failed	2-3
			BIT 9 (↕)	Local / Remote Operating Mode	0 = Local, 1 = Remote	2-3
			BIT 10	Programming OK	1 = Programming OK	2-3
			BIT 11	Programming Fail	1 = Programming Failed	2-3
			BIT 12	Internal Bus programming session	1 = Bus SSI session opened	2-3
			BIT 13	Test Bus programming session	1 = Bus Test session opened	2-3
			BIT 14	Local Bus programming session	1 = Bus Local session opened	2-3
			BIT 15	System Bus programming session	1 = Bus Ext session opened	2-3
102	1	STATE 3 FLAGS	BIT 0 (↕)	Test Session	1 = Test session opened	2-3
			BIT 1 (↕)	Test Unit connected	1 = Test unit connected	2-3
			BIT 2	---	---	
			BIT 3	Signalling module present	1 = Signalling module present	2-3
			BIT 4	Dialog unit present	1 = Dialog unit present	2-3
			BIT 5	Measuring unit present	1 = Measuring unit present	2-3
			BIT 6	Display Off for high temp	1 = Display Off	2-3
			BIT 7	Waiting Trigger	1 =Waiting trigger	2-3
			BIT 8	Datalogger Triggered	1 = Triggered	2-3
			BIT 9	Datalogger stopped	1 = Stopped	2-3
			BIT 10 (↕)	ActiveDualSet	0 = SET1, 1 = SET2	3
			BIT 11	Wink ON	0 = OFF, 1 = ON	2-3
			BIT 12	Signalling Module Input Status	0 = Not active, 1 = Active	2-3
			BIT 13	KK function	0 = OFF, 1 = ON	2-3
			BIT 14	---	---	
			BIT 15	Local Bus Digital Input	0 = OFF, 1 = ON	2-3

Rel addr	# of item	Name	Bit	Description	Notes	PR12x
103	1	STATE 4 ALARM	BIT 0	Vaux Required		2-3
			BIT 1 (↕)	Contact Wear Pre-alarm		2-3
			BIT 2 (↕)	Contact Wear Alarm		2-3
			BIT 3 (↕)	L Pre-alarm		2-3
			BIT 4 (↕)	L Timing		2-3
			BIT 5 (↕)	S Timing		2-3
			BIT 6 (↕)	S2 Timing		3
			BIT 7 (↕)	G Timing		3
			BIT 8 (↕)	G Alarm (Blocked Trip)		3
			BIT 9	---	---	
			BIT 10	---	---	
			BIT 11 (↕)	OT Pre-alarm		2-3
			BIT 12 (↕)	OT Alarm		2-3
			BIT 13 (↕)	OT Alarm (Blocked Trip)		2-3
			BIT 12	---	---	
			BIT 15 (↕)	U Timing		3
104	1	STATE 5 ALARM	BIT 0 (↕)	U Alarm (Blocked Trip)		3
			BIT 1 (↕)	UV Timing		3
			BIT 2 (↕)	UV Alarm (Blocked Trip)		3
			BIT 3 (↕)	OV Timing		3
			BIT 4 (↕)	OV Alarm (Blocked Trip)		3
			BIT 5	---	---	
			BIT 6	---	---	
			BIT 7 (↕)	RP Timing		3
			BIT 8 (↕)	RP Alarm (Blocked Trip)		3
			BIT 9	---	---	
			BIT 10	---	---	
			BIT 11	---	---	
			BIT 12	---	---	
			BIT 13 (↕)	---	---	
			BIT 14 (↕)	Iw Warning		2-3
			BIT 15 (↕)	LC1 Alarm		2-3
105	1	STATE 6 ALARM	BIT 0 (↕)	LC2 Alarm		2-3
			BIT 1 (↕)	IA Sensor error	---	2-3
			BIT 2 (↕)	IA_2 Sensor error	---	2-3
			BIT 3 (↕)	IB Sensor error	---	3
			BIT 4 (↕)	IB_2 Sensor error	---	3
			BIT 5 (↕)	CB Device error	---	2-3
			BIT 6 (↕)	TC Error		2-3
			BIT 7 (↕)	Rating Plug Error		2-3
			BIT 8 (↕)	Key Plug Error		2-3
			BIT 9	Internal Error		2-3
			BIT 10	---	---	
			BIT 11	---	---	
			BIT 12	Invalid Date		2-3
			BIT 13 (↕)	Configuration Error	(dip error, neutral setting, ….)	2-3
			BIT 14 (↕)	CB Status Error		
			BIT 15	Local Bus Analog Value	0 = under/equal threshold 1 = over threshold	2-3

Rel addr	# of item	Name	Bit	Description	Notes	PR12x
106	1	STATE 7 INPUTS /OUTPUTS	BIT 0	Local bus Relè 1 contact	0 = open, 1 = closed	2-3
			BIT 1	Local bus Relè 2 contact	0 = open, 1 = closed	2-3
			BIT 2	Local bus Relè 3 contact	0 = open, 1 = closed	2-3
			BIT 3	Local bus Relè 4 contact	0 = open, 1 = closed	2-3
			BIT 4	---	---	
			BIT 5	Local bus Relè 6 contact	0 = open, 1 = closed	2-3
			BIT 6	Local bus Relè 7 contact	0 = open, 1 = closed	2-3
			BIT 7	Local bus Relè 8 contact	0 = open, 1 = closed	2-3
			BIT 8	Relè P1 contact	0 = open, 1 = closed	2-3
			BIT 9	Relè P2 contact	0 = open, 1 = closed	2-3
			BIT 10	Relè P3 contact	0 = open, 1 = closed	2-3
			BIT 11	Relè P4 contact	0 = open, 1 = closed	2-3
			BIT 12	S zone selectivity input	1 = input active	2-3
			BIT 13	S zone selectivity output	1 = output active	2-3
			BIT 14	G zone selectivity input	1 = input active	3
			BIT 15	G zone selectivity output	1 = output active	3
107	1	STATE 8 LATCHED Note 5	BIT 0 (↑)	L tripped	1 = L trip	2-3
			BIT 1 (↑)	S tripped	1 = S trip	2-3
			BIT 2 (↑)	S2 tripped	1 = S2 trip	3
			BIT 3 (↑)	I	1 = I trip	2-3
				MCR tripped	1 = MCR trip	2-3
			BIT 4 (↑)	Iinst tripped	1 = Iinst trip	2-3
			BIT 5 (↑)	G tripped	1 = G trip	3
			BIT 6	---	---	
			BIT 7 (↑)	OT tripped	1 = OT trip	2-3
			BIT 8	---	---	
			BIT 9 (↑)	U tripped	1 = U trip	3
			BIT 10 (↑)	UV tripped	1 = UV trip	3
			BIT 11 (↑)	OV tripped	1 = OV trip	3
			BIT 12	---	---	
			BIT 13 (↑)	RP tripped	1 = RP trip	3
			BIT 14	---	---	
			BIT 15	---	---	
108	1	STATE 9 LATCHED Note 5	BIT 0 (↑)	Electronic Trip Test	---	2-3
			BIT 1 (↑)	Simulated Trip from Test Unit	---	2-3
			BIT 2 (↑)	External Input Trip	---	2-3
			BIT 3 (↑)	Hardware Error Trip	---	2-3
			BIT 4	---	---	
			BIT 5	---	---	
			BIT 6	---	---	
			BIT 7	---	---	
			BIT 8	---	---	
			BIT 9	---	---	
			BIT 10	---	---	
			BIT 11	---	---	
			BIT 12	---	---	
			BIT 13	---	---	
			BIT 14	---	---	
			BIT 15	TRIP command fail	1= TRIP command failed	2-3

Note 4: GLITCH registers are automatically cleared after reading.

Note 5: LATCHED registers are set when the associated event happens; they are seret only by “CB RESET” or “TRIP RESET”commands.

8.5 TIME

Rel addr	*# of item*	*Name*	*Description*	*PR12x*
100	1	Day	Number of days from 31/12/1999	2-3
101	1	Hour & minute	MSB = Hour, LSB = minute	2-3
102	1	Second	0 – 59	2-3
103	1	Millisecond	0 -999	2-3

⚠ As shown in REGISTER MAP (3.2), the TIME update could be done only using modbus function 16. In order to modify the Time it is necessary to open the programming session, the data come immediately modified and not at the end of the programming session as it happens for the normal parameters, therefore the abandonment (abort) of the programming session do not cancel the carried out modification.
It's recommended to update simultaneously all four TIME registers.

8.6 RUN-TIME MEASURES

The measure limits shown in column "Notes" are depicted in MEASURE LIMITS AND REPRESENTATIONS.

Rel addr	*# of item*	*Name*	*Description*	**Notes**	*PR12x*
200	2	Maximum current (rms)	[A]	Not available $\rightarrow 2^{32}$-1 $I < I_{MIN} \rightarrow 0$ $I > I_{MAX} \rightarrow I_{MAX}$	2-3
202	1	Maximum current polarity	0→ Not available, 1→ IA 2→ IA_2 3→ IB 4→ IB_2	Not available → 0	2-3
203	2	IA current (rms)	[A]	Not available $\rightarrow 2^{32}$-1 $I < I_{MIN} \rightarrow 0$ $I > I_{MAX} \rightarrow I_{MAX}$	2-3
205	2	IA_2 current (rms) (*)			2-3
207	2	IB current (rms)			3
209	2	IB_2 current (rms) (*)			3
211	2	Ground current (rms)		Not available $\rightarrow 2^{32}$-1 $I < I_{MIN} \rightarrow 0$	3
213	---	---	---	---	---
215	---	---	---	---	---
217	1	V voltage (rms)	[V $*10^{-1}$]	Not available $\rightarrow 2^{16}$-1 $V < V_{MIN} \rightarrow 0$ $V > V_{MAX} \rightarrow V_{MAX}$	3
218	2	Total active power	[kW $*10^{-1}$] (signed)	Not available $\rightarrow 2^{31}$-1 $\mid P \mid < P_{MIN} \rightarrow 0$ $P > P_{MAX} \rightarrow P_{MAX}$ $P < -P_{MAX} \rightarrow -P_{MAX}$	3
220	2	Positive Active Energy	[KWh] (signed)	$E < -2^{31} \rightarrow -2^{31}$ $E > 2^{31}-1 \rightarrow 2^{31}-1$	3
222	2	Negative Active Energy	[KWh] (signed)		3
224	2	Total Active Energy	[KWh] (signed)		3

8.7 INFORMATION

Rel addr	*# of item*	*Name*	*Range*	*Description*	*PR12x*
700	1	Slave ID	0x58 0x59	PR123DC PR122DC	2-3
701	1	SW version	Major + minor		2-3
702	1	Product Standard Reference	0 ÷ 1	0→IEC 1→ UL	2-3
703	1	Number of semipoles	0 ÷ 1	0 → 1 Polo, 1 → 2 semipoli	2-3
704	1	In (nominal current)	100 ÷ 6300	[A]	2-3
705	1	CB type	TAB_CB_TYPE	TAB_CB_TYPE	2-3
706	8	CB Serial Number	Caratteri in formato ASCII	Caratteri in formato ASCII	2-3
714	1	Datalogger max file	0 ÷ 3	0 ÷ 3	2-3
715	1	Datalogger max address	0 ÷ 65535	0 ÷ 65535	2-3
716	1	Datalogger Trigger	0 ÷ 4	0 = None (free running) 1 = Any Alarm 2 = L Timing 3= Any Trip 4 = Custom	2-3
717	1	Day of Dlogger trigger	Number of days from 31/12/1999		2-3
718	1	Hour & minute of Dlog trigger	Hour & minute	MSB = Hour, LSB = minute	2-3
719	1	Second of Dlog trigger	Seconds		2-3
720	1	Millisecond of Dlog trigger	Milliseconds		2-3
721	2	---	---	---	---
723	6	CB name	Caratteri in formato ASCII		2-3

8.8 PARAMETERS CONFIGURATION 1

Rel addr	*# of item*	*Name*	*Range*	*Description*	*PR12x*
1000	1	Product execution	1	0→LI 1→LSI 2→LSIG	2-3
1001	8	Relay Serial Number	Caratteri in formato ASCII	---	2-3

8.9 PARAMETERS CONFIGURATION 2

Rel addr	*# of item*	*Name*	*Range*	*Description*			*PR12x*
1020	1	Unit configuration	0x0000 ÷ 0x003F	Bit	Bit = 0	Bit = 1	
				0	---	---	
				1	Local Bus Unit = assente	Local Bus Unit = presente	2-3
				2	Module = PR120/V	Module = PR120/LV	2-3
				3	---	---	
				4	PowerDir = NORMAL	PowerDir = REVERSE	3
				5	---	---	
				6	Operating mode = Local	Operating mode = Remote	2-3
1021	1	Language	0 ÷ 4	0 = ENG 1 = EN 2 = FRA 3 = GER 4 = SPA			2-3
1022	1	---	---	---			---
1023	1	---	---	---			---
1024	1	PR120/V Nominal voltage	12 ÷ 1000 step 1	12 … 1000 V step 1 V			2-3
1025	1	PR120/LV Nominal voltage	12 ÷ 250 step 1	12 … 250 V step 1 V			2-3
1026	---	---	---	---			---
1027	---	---	---	---			---
1028	1	Slave Address (external bus only)	1 ÷ 247	1 ÷ 247			2-3
1029	1	Addressing Type (external bus only)	0 ÷ 1	0 = standard 1 = ABB			2-3
1030	1	Baud rate (external bus only)	0 ÷ 1	0 = 9600 1 = 19200			2-3
1031	1	Protocol Type (external bus only)	0 ÷ 3	0 = “E,8,1” 1 = “O,8,1” 2 = “N,8,2” 3 = “N,8,1”			2-3

8.10 PARAMETERS CONFIGURATION 3

Rel addr	# of item	Name	Range	Description			PR12x
1050	1	Configuration	0x0000 ÷ 0x007F	Bit	Bit = 0	Bit = 1	
				0	Par set = set A	Par set = set B	3
				1	DualSetting = OFF	DualSetting = ON	3
				2	---	---	
				3	---	---	
				4	---	---	
				5	---	---	
				6	Dualset CB close disable	Set B on CB close	3
				7	Dualset Vaux disable	Set B on Vaux OFF	3
				8	Dual Set Local Bus disable	Set B on Local Bus Digital Input ON	3
1051	1	Measurement store time	5 ÷ 120 step 5 [min]	5 ÷ 120 min			2-3
1052	1	Loc Bus Relais Unit Contact config	TAB_RELAYS_K51_CONFIG	TAB_RELAYS_K51_CONFIG			2-3
1053	1	Loc Bus Relais 1 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1054	1	Loc Bus Relais 1 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1055	1	Loc Bus Relais 2 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1056	1	Loc Bus Relais 2 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1057	1	Loc Bus Relais 3 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1058	1	Loc Bus Relais 3 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1059	1	Loc Bus Relais 4 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1060	1	Loc Bus Relais 4 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1061	1	Loc Bus Relais 6 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1062	1	Loc Bus Relais 6 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1063	1	Loc Bus Relais 7 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1064	1	Loc Bus Relais 7 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1065	1	Loc Bus Relais 8 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1066	1	Loc Bus Relais 8 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1067	1	P Relays Contact config	TAB_P_RELAY_CONFIG	TAB_P_RELAY_CONFIG			2-3
1068	1	P1 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1069	1	P1 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1070	1	P2 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1071	1	P2 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1072	1	P3 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1073	1	P3 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1074	1	P4 Function	0 ÷ 65535	TAB_RELAYS_FUNCTION			2-3
1075	1	P4 Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3
1076	1	Programmable Input config	0x0000 ÷ 0x0001	0 = Attivo basso 1 = Attivo alto			2-3
1077	1	Programmable Input Function	0 ÷ 5	0 = Generic 1 = External TRIP 2 = Trip reset 3 = Set B (only PR123DC) 4 = Dial Local 5 = Reset Signalling Module 6 = Energy reset (only PR123DC)			2-3
1078	1	Programmable Input Delay	0.00 ÷ 100.00 step 0.01 [s]	0 ÷ 10000 [s*10^{-2}]			2-3

Rel addr	*# of item*	*Name*	*Range*	*Description*	*PR12x*
1079	1	Data Logger Config	0x0000 ÷ 0x0001	0 = Data Logger = OFF 1 = Data Logger = ON	2-3
1080	1	Data Logger Trigger Type	Standard: 0 ÷ 3 Custom 256 ÷ 65535 (vedi Trigger setting)	Standard: 0 = None (free running) 1 = Any Alarm 2 = L Timing 3 = Any Trip	2-3
1081	1	Data Logger Stop Delay	0.00 ÷ 10.00 step 0.01 [s]	0 ÷ 1000 [s*10^{-2}]	2-3
1082	1	Data Logger Frequency	0 ÷ 3	0 = 600 Hz 1 = 1200 Hz 2 = 2400 Hz 3 = 4800 Hz	2-3
1083	---	---	---	---	---
1084	5	CB TAG name	Caratteri in formato ASCII		2-3
1089	5	User data	Caratteri in formato ASCII		2-3
1094	1	Dual set CB close time	0.20 ÷ 50.00 step 0.10 [s]	20 ÷ 5000 [s*10^{-2}]	3
1095	1	Date of installation CB	Number of days from 31/12/1999		2-3
1096	1	Date of last maint CB	Number of days from 31/12/1999		2-3
1097	1	Local Bus analog value threshold	0 ÷ 65535	0 ÷ 65535	2-3
1098	1	Startup current activation threshold	0.10 ÷ 10.00 step 0.10 [In]	10 ÷ 1000 [In*10^{-2}]	2-3

8.11 PARAMETERS PROTECTION SET1/SET2

The following table shows parameters included in protection SET1 and SET2 areas. Column "*Rel addr*" reports SET1 addresses (1100 ÷ 1178); SET2 addresses (1200 ÷ 1278) can be obtained adding 100 to SET1 addresses.

Rel addr	*# of item*	*Name*	*Range*	*Description*			*PR12x*
1100	1	Prot L configuration		Bit	Bit = 0	Bit = 1	
				0	---	---	
				1	---	---	
				2	---	---	
				3	---	---	
				4	Thermal mem = OFF	Thermal mem = ON	2-3
1101	---	---	---	---			---
1102	---	---	---	---			---
1103	---	---	---	---			---
1104	1	Prot L threshold	0.40 ÷ 1.00 step 0.01 [In]	40 ÷ 100 [In*10^{-2}]			2-3
1105	1	Prot L time	3 ÷ 102 step 3 [s]	300 ÷ 10200 [s*10^{-2}]			2-3
1106	1	Prot S configuration		Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	2-3
				1	---	---	
				2	Start Up Th = OFF	Start Up Th = ON	2-3
				3	Zone sel = OFF	Zone sel = ON	2-3
				4	Termal mem = OFF	Termal mem = ON	2-3
1107	1	Prot S curve type	0→ T=k, 1→ I^2t = k	0 ÷ 1			2-3
1108	1	Prot S threshold T=k/I^2	0.6 ÷ 10.0 step 0.1 [In]	60 ÷ 1000 [In*10^{-2}]			2-3
1109	1	Prot S time T=k/I^2	0.05 ÷ 0.35 step 0.01[s]	5 ÷ 35 [s*10^{-2}]			2-3
1110	1	Prot S threshold T=k	0.6 ÷ 10.0 step 0.1 [In]	60 ÷ 1000 [In*10^{-2}]			2-3
1111	1	Prot S time T=k	0.05 ÷ 0.35 step 0.01[s]	5 ÷ 35 [s*10^{-2}]			2-3
1112	1	Prot S start up threshold	0.6 ÷ 10.0 step 0,1 [In]	60 ÷ 1000 [In*10^{-2}]			2-3
1113	1	Prot S start up time	0.10 ÷ 30.00 step 0.01 [s]	10 ÷ 3000 [s*10^{-2}]			2-3
1114	1	Prot S zone selectivity time	0.04 ÷ 0.20 step 0.01 [s]	4 ÷ 20 [s*10^{-2}]			2-3
1115	1	Prot S2 configuration		Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	3
				1	---	---	
				2	Start Up Th = OFF	Start Up Th = ON	3
				3	Zone sel = OFF	Zone sel = ON	3
1116	1	Prot S2 threshold T=k	0.6 ÷ 10.0 step 0.1 [In]	60 ÷ 1000 [In*10^{-2}]			3
1117	1	Prot S2 time T=k	0.05 ÷ 0.35 step 0.01[s]	5 ÷ 35 [s*10^{-2}]			3
1118	1	Prot S2 start up threshold	0.6 ÷ 10.0 step 0,1 [In]	60 ÷ 1000 [In*10^{-2}]			3
1119	1	Prot S2 start up time	0.10 ÷ 30.00 step 0.01 [s]	10 ÷ 3000 [s*10^{-2}]			3
1120	1	Prot S2 zone selectivity time	0.04 ÷ 0.20 step 0.01 [s]	4 ÷ 20 [s*10^{-2}]			3

Rel addr	# of item	Name	Range	Description			PR12x
				Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	2-3
				1	---	---	
1128	1	Prot I configuration		2	Start Up Th = OFF	Start Up Th = ON	2-3
				3	---	---	
				4	---	---	
1129	1	Prot I threshold	1,5 ÷ 10 step 0.1 [In]	150 ÷ 1000 [In*10^{-2}]			2-3
1130	1	Prot I start up threshold	1,5 ÷ 10 step 0.1 [In]	150 ÷ 1000 [In*10^{-2}]			2-3
1131	1	Prot I start up time	0.10 ÷ 30.00 step 0.01 [s]	10 ÷ 3000 [s*10^{-2}]			2-3
				Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	3
				1	Trip disable	Trip	3
1132	1	Prot G configuration		2	Start Up Th = OFF	Start Up Th = ON	3
				3	Zone sel = OFF	Zone sel = ON	3
				4	Termal mem = OFF	Termal mem = ON	3
1133	1	Prot G curve type	0⟶ T=k, 1⟶ I^2t = k	0 ÷ 1			3
1134	1	Prot G threshold T=k/I^2	0.2 ÷ 1.0 step 0.02 [In]	20 ÷ 100 [In*10^{-2}]			3
1135	1	Prot G time T=k/I^2	0.1 ÷ 1.0 step 0.05 [s]	10 ÷ 100 [s*10^{-2}]			3
1136	1	Prot G threshold T=k	0.2 ÷ 1.0 step 0.02 [In]	20 ÷ 100 [In*10^{-2}]			3
1137	1	Prot G time T=k	0.1 ÷ 1.0 step 0.05 [s]	10 ÷ 100 [s*10^{-2}]			3
1138	1	Prot G start up threshold	0.2 ÷ 1.0 step 0.02 [In]	20 ÷ 100 [In*10^{-2}]			3
1139	1	Prot G start up time	0.10 ÷ 30.00 step 0.01 [s]	10 ÷ 3000 [s*10^{-2}]			3
1140	1	Prot G zone selectivity time	0.04 ÷ 0.20 step 0.01 [s]	4 ÷ 20 [s*10^{-2}]			3
				Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	3
				1	Trip disable	Trip enable	3
1150	1	Prot U configuration		2	---	---	---
				3	---	---	---
				4	---	---	---
				5	---	---	---
1151	1	Prot U threshold	2 ÷ 90 step 1 [%]	2 ÷ 90 [%]			
1152	1	Prot U time	0.5 ÷ 60 step 0.5 [s]	50 ÷ 6000 [s*10^{-2}]			
				Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	3
				1	Trip disable	Trip enable	3
1153	1	Prot UV configuration		2	---	---	
				3	---	---	
				4	---	---	
1154	1	Prot UV threshold	0.50 ÷ 0.95 step 0.01 [Un]	50 ÷ 95 [Un*10^{-2}]			3
1155	1	Prot UV time	0.1 ÷ 5.0 step 0.1 [s]	10 ÷ 500 [s*10^{-2}]			3
				Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	3
				1	Trip disable	Trip enable	3
1156	1	Prot OV configuration		2	---	---	
				3	---	---	
				4	---	---	
1157	1	Prot OV threshold	1.05 ÷ 1.20 step 0.01 [Un]	105 ÷ 120 [Un*10^{-2}]			3
1158	1	Prot OV time	0.1 ÷ 5.0 step 0.1 [s]	10 ÷ 500 [s*10^{-2}]			3
1159	---	---	---	---			
1160	---	---	---	---			
1161	---	---	---	---			
				Bit	Bit = 0	Bit = 1	
				0	Prot disable	Prot enable	3
				1	Trip disable	Trip enable	3
1162	1	Prot RP configuration		2	---	---	
				3	---	---	
				4	---	---	
1163	1	Prot RP threshold	-0.10 ÷ -0.30 step 0.02 [Pn_t]	10 ÷ 30 [-Pn_t *10^{-2}]			3
1164	1	Prot RP time	0.5 ÷ 25.0 step 0.1 [s]	50 ÷ 2500 [s*10^{-2}]			3

Rel addr	# of item	Name	Range	Description			PR12x
1165	---	---	---	---			---
1166	---	---	---	---			---
1167	---	---	---	---			---
1168	---	---	---	---			---
1169	---	---	---	---			---
1170	---	---	---	---			---
1171	1	Prot OT configuration		Bit	Bit = 0	Bit = 1	
				0	---	---	
				1	Trip disable	Trip enable	2-3
				2	---	---	
				3	---	---	
				4	---	---	
1172	1	Load control configuration	0x0000 ÷ 0x0007	Bit	Bit = 0	Bit = 1	
				0	Iw Th disabled	Iw Th enabled	2-3
				1	LC1 Th disabled	LC1 Th enabled	2-3
				2	LC2 Th disabled	LC2 Th enabled	2-3
1173	1	Warning current Iw	0.30 ÷ 10.00 step 0.05 [In]	30 ÷ 1000 [In*10^{-2}]			2-3
1174	1	LC1 threshold	50 ÷ 100 step 1 [%I_1]	50 ÷ 100 [%I_1]			2-3
1175	1	LC2 threshold	50 ÷ 100 step 1 [%I_1]	50 ÷ 100 [%I_1]			2-3
1176	---	---	---	---			
1177	---	---	---	---			
1178	---	---	---	---			
1179	1	MCR Config		Bit	Bit = 0	Bit = 1	
				0	MCR disable	MCR enable	2-3
1180	1	MCR Threshold	6 ÷ 10 step 0.1 [In]	600 ÷ 1000 [In*10^{-2}]			2-3
1181	1	MCR Time	0.04 ÷ 0.5 step 0.01 [s]	4 ÷ 50 [s*10^{-2}]			2-3

8.12 TRIP HISTORY

Rel addr	*# of item*	*Name*		*Description*	*PR12x*
2000	19	Trip history no. 1 (new)	0	MARKER (0 = valid)	2-3
			1	Trip Type TAB_TRIP_TYPE	2-3
			2	N° trip	2-3
			3	Date (day)	2-3
			4	Date (MSB = hours, LSB = min)	2-3
			5	Date (seconds)	2-3
			6	Date (ms)	2-3
			7÷8	Polarity maximum current	2-3
			9÷10	Current IA	2-3
			11÷12	Current IB	2-3
			13÷14	---	2-3
			15	Contact wear	2-3
			16	TAB_TRIP_TYPE	2-3
			17	TAB_TRIP_TYPE	2-3
			18	TAB_TRIP_TYPE	2-3
2019	19	Trip history N° 2		"	2-3
…	19	Trip history N° 3		"	2-3
…	19	Trip history N° 4		"	2-3
…	19	Trip history N° 5		"	2-3
…	19	Trip history N° 6		"	2-3
…	19	Trip history N° 7		"	2-3
…	19	Trip history N° 8		"	2-3
…	…	….		"	2-3
2361	19	Trip history N° 20 (old)		"	2-3

Table 7 TAB_TRIP_TYPE

Trip type	word 1	word 16	word 17	word 18
L	1	In Active threshold = value / 512	See addr. 1100	---
S	2	In Active threshold = value / 512	Time set ms	See addr. 1106
S2	3	In Active threshold = value / 512	Time set ms	See addr. 1115
I	7	0x0000	In Active threshold = value / 512	See addr. 1128
MCR		0xABCD	In Active threshold = value / 512	Time set ms
G	8	Ground Current Low	Ground Current High	In Active threshold = value / 512
OT	10	Temperature °C = value * 0,073855	See addr. 705	See addr. 704
UV	11	---	---	Voltage (rms)
OV	12	---	---	Voltage (rms)
RP	14	Total Active Power Low	Total Active Power High	---
UN	17	0xABCD	Soglia attiva % = value / 10	Time set ms
EXT	18	See addr. 1078	See addr. 1076	See addr. 1077
Hw Trip	21	See addr. 105	See addr. 1401	See addr. 1500
Iinst	22	See addr. 704	See addr. 705	See addr. 105

8.13 MEASURE HISTORY

Rel addr	*# of item*	*Name*		*Description*
2500	24	Measure history n° 1 (new)	0	MARKER (0 = valid)
			1	History code: 0 = NORMAL_HISTORY 1 = POWER_UP 2 = NEW_PERIOD
			2	Period from last save (minutes)
			3	Number of days from 31/12/1999
			4	MSB = Hour, LSB = minute
			5	Medium Active Power LOW
			6	Medium Active Power HIGH
			7	Maximum Active Power LOW
			8	Maximum Active Power HIGH
			9	Polarity maximum current (1 = IA, 2 = IB)
			10	Maximum current LOW
			11	Maximum current HIGH
			12	---
			13	Maximum voltage
2524	24	Measure history n°2		"
2548	24	Measure history n°3		"
…	24	…		"
3052	24	Measure history n°24		"
3076	24	Measure history n°25 (old)		"

8.14 LOG EVENTS

Rel addr	*# of item*	*Name*	*Description*	*PR12x*
3300	6	Log event n° 1 (new)	MARKER (0 = valid)	2-3
			Event type TAB_LOG_EVENTS	2-3
			Number of days from 31/12/1999	2-3
			MSB = Hour, LSB = minute	2-3
			Seconds	2-3
			Milliseconds	2-3
3306	6	Log event n° 2	"	2-3
3312	6	Log event n° 3	"	2-3
…	6	…	"	2-3
3768	6	Log event n° 79	"	2-3
3774	6	Log event n° 80 (old)	"	2-3

9. TABLES

Table 8 TAB_RELAYS_FUNCTION

Value	Description
0	None
1	L prealarm
2	L timing
3	S timing
4	L trip
5	S trip
6	I trip
7	G trip
8	Any trip
9	Any Alarm
10	LC1
11	LC2
256 ÷ 65535	Custom Setting of the activation relay function

Table 9 TAB_RELAYS_K51_CONFIG

	Bit = 0	Bit = 1
Bit 0	Relè K51/1 not latched	Relè K51/1 latched
Bit 1	Relè K51/2 not latched	Relè K51/2 latched
Bit 2	Relè K51/3 not latched	Relè K51/3 latched
Bit 3	Relè K51/4 not latched	Relè K51/4 latched
Bit 4	Relè K51/6 not latched	Relè K51/6 latched
Bit 5	Relè K51/7 not latched	Relè K51/7 latched
Bit 6	Relè K51/8 not latched	Relè K51/8 latched
Bit 7	Contact K51/1 NO	Contact K51/1 NC
Bit 8	Contact K51/2 NO	Contact K51/2 NC
Bit 9	Contact K51/3 NO	Contact K51/3 NC
Bit 10	Contact K51/4 NO	Contact K51/4 NC
Bit 11	Contact K51/6 NO	Contact K51/6 NC
Bit 12	Contact K51/7 NO	Contact K51/7 NC
Bit 13	Contact K51/8 NO	Contact K51/8 NC

Table 10 TAB_P_RELAY_CONFIG

	Bit = 0	Bit = 1
Bit 0	Relè P1 not latched	Relè P1 Latched
Bit 1	Relè P2 not latched	Relè P2 Latched
Bit 2	Relè P3 not latched	Relè P3 Latched
Bit 3	Relè P4 not latched	Relè P4 Latched
Bit 4	Contact P1 NO	Contact P1 NC
Bit 5	Contact P2 NO	Contact P2 NC
Bit 6	Contact P3 NO	Contact P3 NC
Bit 7	Contact P4 NO	Contact P4 NC

Table 11 TAB_CB_TYPE

CB	Value	CB	Standard Reference
E2B800	0	Single polarity	IEC
	1	Double polarity	
E2B1000	2	Single polarity	
	3	Double polarity	
E2B1250	4	Single polarity	
	5	Double polarity	
E2B1600	6	Single polarity	
	7	Double polarity	
E2N1600	8	Single polarity	
	9	Double polarity	
E3N800	10	Single polarity	
	11	Double polarity	
E3N1000	12	Single polarity	
	13	Double polarity	
E3N1250	14	Single polarity	
	15	Double polarity	
E3N1600	16	Single polarity	
	17	Double polarity	
E3N2000	18	Single polarity	
	19	Double polarity	
E3N2500	20	Single polarity	
	21	Double polarity	
E3H1600	22	Single polarity	
	23	Double polarity	
E3H2000	24	Single polarity	
	25	Double polarity	
E3H2500	26	Single polarity	
	27	Double polarity	
E4S1600	28	Single polarity	
	29	Double polarity	
E4S2000	30	Single polarity	
	31	Double polarity	
E4S2500	32	Single polarity	
	33	Double polarity	
E4S3200	34	Single polarity	
	35	Double polarity	
E4H3200	36	Single polarity	
	37	Double polarity	
E6H3200	38	Single polarity	
	39	Double polarity	
E6H4000	40	Single polarity	
	41	Double polarity	
E6H5000	42	Single polarity	
	43	Double polarity	
E3N-A800	44	Single polarity	UL
	45	Double polarity	
E3N-A1200	46	Single polarity	
	47	Double polarity	
E3N-A1600	48	Single polarity	
	49	Double polarity	
E3N-A2000	50	Single polarity	
	51	Double polarity	
E3N-A2500	52	Single polarity	
	53	Double polarity	
E4S-A3000	54	Single polarity	
	55	Double polarity	
E6H-A4000	56	Single polarity	
	57	Double polarity	
E6H-A5000	58	Single polarity	
	59	Double polarity	

Table 12 TAB_LOG_EVENTS

Value	Description
0	Parameters changed
1	Signalling reset
2	CB isolated
3	CB connected
4	CB open
5	CB closed
6	CB status defined
7	CB status undefined
8	Internal bus OK
9	Internal bus fault
10	Trip command fail
11	Local mode operating mode
12	Remote mode operating mode
13	Test session closed
14	Test session opened
15	Test unit not connected
16	Test unit connected
17	Set B OFF
18	Set B ON
19	---
20	---
21	Cw Preal OFF
22	Cw Preal ON
23	Cw Alarm OFF
24	Cw Alarm ON
25	L Preal OFF
26	L Preal ON
27	L Timing OFF
28	L Timing ON
29	S Timing OFF
30	S Timing ON
31	S2 Timing OFF
32	S2 Timing ON
33	G Timing OFF
34	G Timing ON
35	G Alarm OFF
36	G Alarm ON
37	---
38	---
39	---
40	---
41	OT Warning OFF
42	OT Warning ON
43	OT Alarm OFF
44	OT Alarm ON
45	OT Alarm Block OFF
46	OT Alarm Block ON
47	---
48	---
49	U Timing OFF
50	U Timing ON
51	U Alarm OFF
52	U Alarm ON
53	Uv Timing OFF
54	Uv Timing ON
55	Uv Alarm OFF
56	Uv Alarm ON
57	Ov Timing OFF
58	Ov Timing ON
59	Ov Alarm OFF
60	Ov Alarm ON
61	---
62	---
63	---
64	---
65	Rp Timing OFF
66	Rp Timing ON
67	Rp Alarm OFF
68	Rp Alarm ON
69	---
70	---
71	---
72	---
73	---
74	---
75	---
76	---
77	---
78	---
79	Iw Alarm OFF
80	Iw Alarm ON
81	Lc1 OFF
82	Lc1 ON
83	Lc2 OFF
84	Lc2 ON
85	IA Sensor Alarm OFF
86	IA Sensor Alarm ON
87	IA2 Sensor Alarm OFF
88	IA2 Sensor Alarm ON
89	IB Sensor Alarm OFF
90	IB Sensor Alarm ON
91	IB2 Sensor Alarm OFF
92	IB2 Sensor Alarm ON
93	CB Device Alarm OFF
94	CB Device Alarm ON
95	TC Alarm OFF
96	TC Alarm ON
97	Rating Plug Alarm OFF
98	Rating Plug Alarm ON
99	Key Plug error OFF
100	Key Plug error ON
101	---
102	---
103	---
104	---
105	---
106	---
107	CB status error OFF
108	CB status error ON
109	L tripped
110	S tripped
111	S2 tripped
112	I tripped
113	Iinst tripped
114	G tripped
115	---
116	OT tripped
117	---
118	U tripped
119	UV tripped
120	OV tripped
121	---
122	RP tripped
123	---
124	---
125	Electonic trip test
126	Simulated trip from test unit
127	External input trip
128	Hardware Error Trip
129	Aux On
130	Trip Reset Ev
131	History Trip Reset
132	History Measure Reset
133	Energy Reset
134	Aux Voltage On
135	Aux Ext On

10. CHECK OF PARAMETERS ACCURACY

During the programming the accuracy checks of new parameters set are carried out, in particular:

1. All parameter values are in the admitted ranges (also if relevant to protection in off)
2. If S protection is ON: Threshold S > Threshold L
3. If S and I protections are ON: Threshold I > Threshold S

In case one of these checks failed the reply of exception 'ILLEGAL DATA ERROR' is done supplying in the 'Programming Fail Error Code' the relevant error code.

11. OPERATION DESCRIPTION

11.1 PARAMETER PROGRAMMING

There is a validity programming session timeout of 5 minutes once empire the session is aborted; to extend it of 5 minutes more it is sufficient to re-send an open programming session command.

Through the system bus it is allowed to open a programming session only in REMOTE functioning mode.

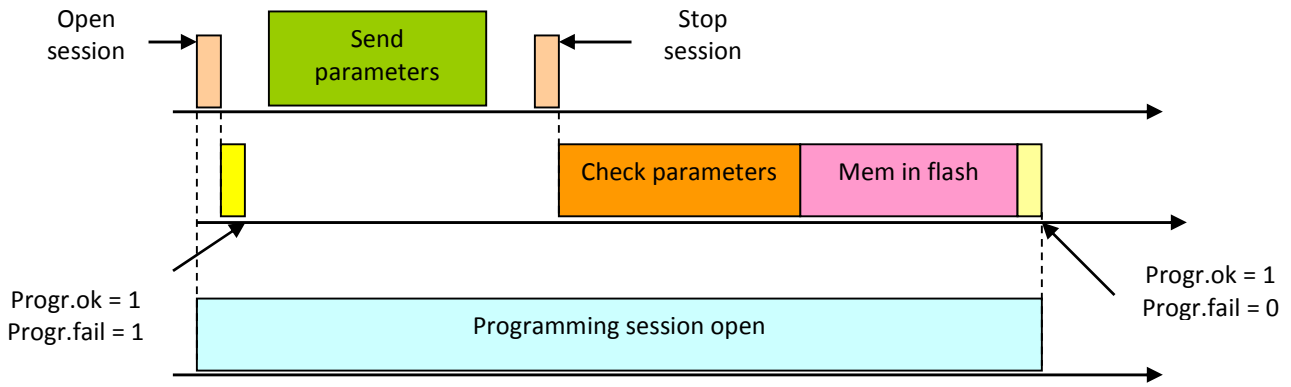


Figure 1 Programming session correctly handled

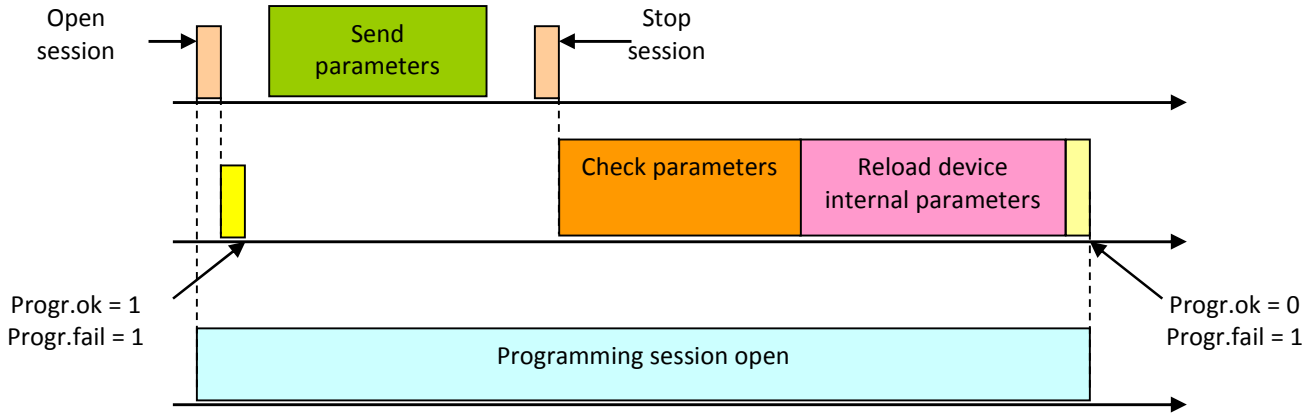


Figure 2 Programming failed

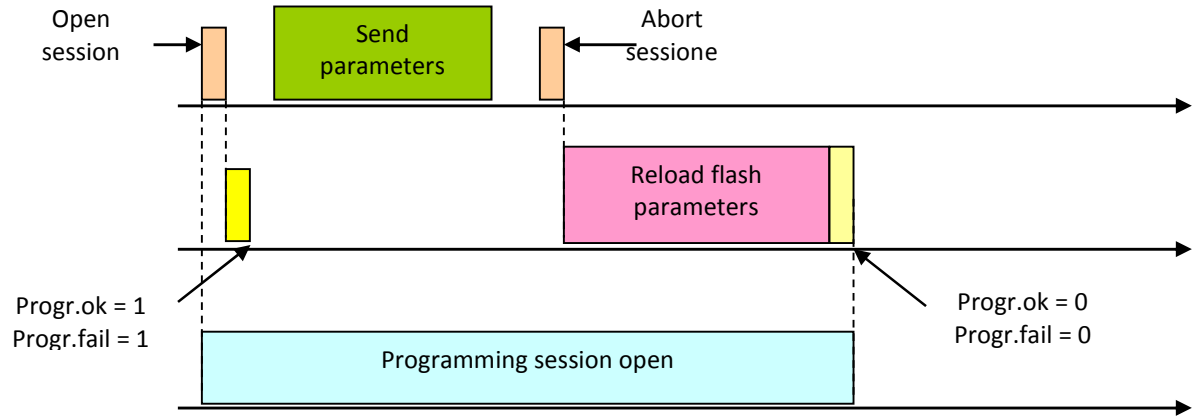


Figure 3 Programming aborted

11.2 DATALOGGER

Through the datalogger functionality is possible to execute the recording of some analogic and digital writings for a temporal window of definable duration and synchronized by a setteble event.
The following figure shows in yellow the temporal window, the trigger and the available samples.

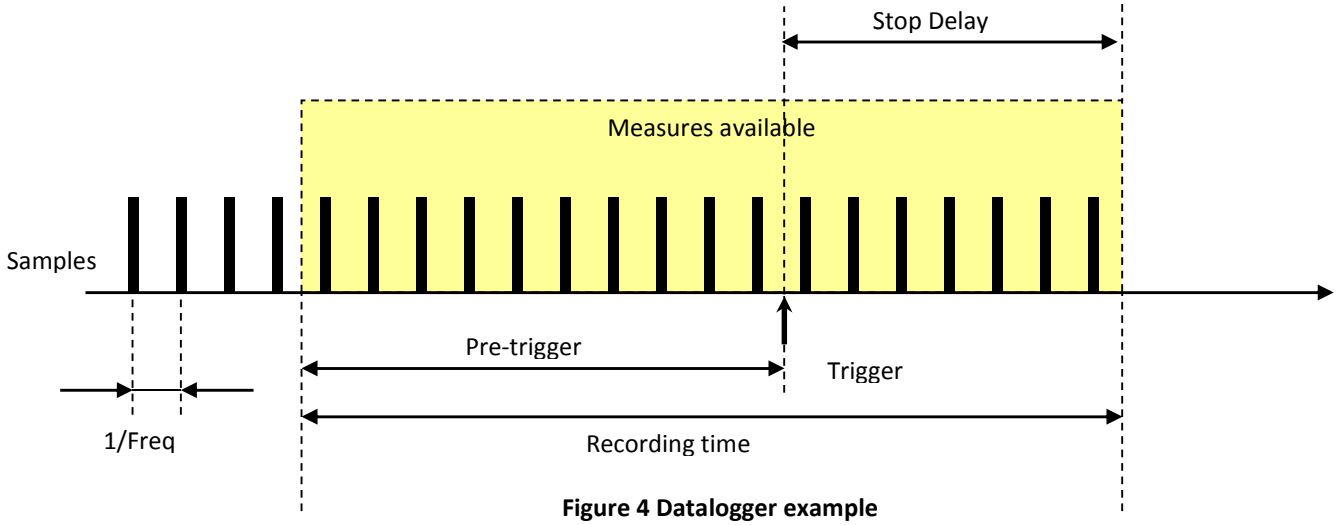


Figure 4 Datalogger example

The user can select the sampling frequency, the trigger event type and the stop delay for obtaining the pre-trigger expected towards the selected event.

According to the stop delay set there will be 3 situations:

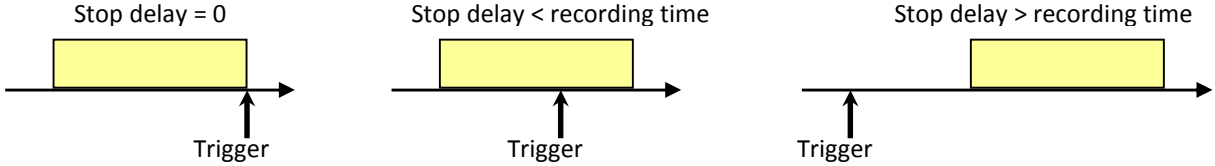


Figure 5 Three situations of recording

The maximum length of recording is defined exclusively by the sample frequency set as described in table TAB DLOG RECORDING TIME, in the case the sum of the stop delay and the time elapsed between a restart trigger is lower than the maximum recording time, there will be a recording time lower than the maximum one as shown in the following figure:

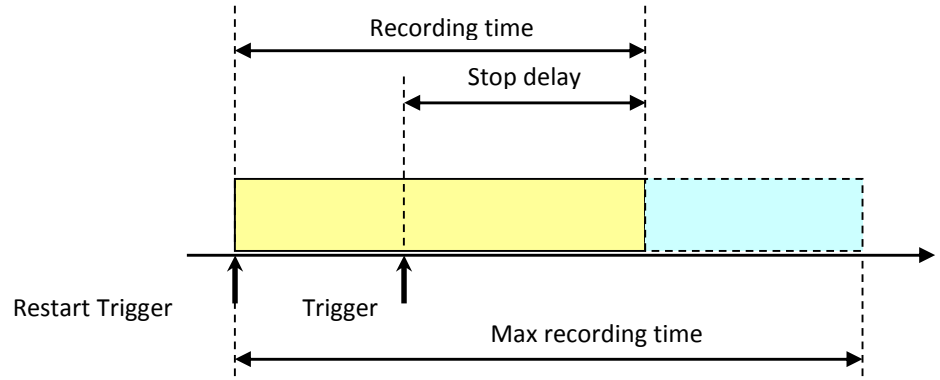


Figure 6 Recording time lower than maximum

11.2.1 Recorded data

When the trigger event happens or at the reception of the stop command, the following data are recorded in the box INFORMATION:

- Datalogger Trigger that shows the trigger type that has caused the datalogger stop.
- Time-stamp of the trigger event (day/hour+minutes/seconds/milliseconds) (4 word)
- Datalogger max file that shows which is the max file with importante data that can be apply by function 70
- Datalogger max address that shows which is the max address with important data that can be apply by function 70

For each sampling period 13 word are recorded with, in order, the following information:

1. current sample IA (1 word)
2. current sample IA_2 (1 word)
3. current sample IB (1 word)
4. current sample IB_2 (1 word)
5. current sample IA MSP (1 word)
6. current sample IA_2 MSP (1 word)
7. current sample IB MSP (1 word)
8. current sample IB_2 MSP (1 word)
9. voltage sample (1 word)
10. digital inputs (1 word)
11. alarms1 (1 word)
12. alarms2 (1 word)
13. trip (1 word)

The data recorded may be read (only when the datalogger is stopped) in the MODBUS MAP.

11.2.2 Trigger state information

In STATEE the following information of datalogger state are supplied:

- **Waiting trigger**: shows that the datalogger is suitable and is waiting for the happening of the event chosen as trigger
- **Datalogger triggered**: shows that the trigger event happened and the datalogger is under recording
- **Datalogger stopped**: shows that the recording was completed because it finished or completed or by a stop datalogger command

The datalogger recordings may be read in the MODBUS MAP only when the datalogger is not in phase of recording, that is when the datalogger stopped is signaled.

11.2.3 Datalogger settings

In PARAMETERS CONFIGURATION **Error! Reference source not found.**the configuration parameters of datalogger, described below, are present.

Note: following any modification of datalogger parameters this is stopped, to restart it is necessary to reset the trigger with the restart trigger

11.2.3.1 Datalogger activation

To function datalogger it is necessary to activate it by HMI or by the system with datalogger config. parameters.

11.2.3.2 Datalogger activation

It's necessary to send a command of restart trigger (by HMI or by system) to activate the datalogger

11.2.3.3 Saving frequency setting

Both by HMI and by system it is possible, through the datalogger frequency parameter, the frequency by which the measures among 4 fixed frequencies 600Hz, 1200Hz, 2400Hz or 4800Hz are saved.

The memory used by datalogger is 512Kbyte therefore memorizing 16 words (32 byte) the maximum number (theoretic) of recordings is 16384, therefore, according to the frequency set different recording times are obtained as shown in the following table:

Frequency	RECORDING TIME
600 Hz	27,307 s
1200 Hz	13,653 s
2400 Hz	6,827 s
4800 Hz	3,413 s

Table 13 TAB DLOG RECORDING TIME

11.2.3.4 Trigger setting

11.2.3.4.1 Trigger standard

By HMI it is possible to select, through the datalogger trigger type parameter, one of the following trigger:

0. None (free running)
1. Any alarm
2. L timing
3. Any Trip

In case 1 None (free running) no trigger is setted and the datalogger may be stopped only with a stop command by HMI or by system.

11.2.3.4.2 Trigger custom

Writing in "**Data logger Trigger Type"** (inserted on PARAMETERS CONFIGURATION a value on range 0-3, will set up one of the three standard trigger (0 = None, 1 = Any alarm, 2 = L timing, 3 = Any Trip); writing a value greater than list values, it's possible to configure custom functionality as described in the following table.

Bit di Datalogger Trigger Type															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
OR AND	Not Used		Byte placement (offset from 0x100 address) in the STATE					Bits mask to be monitored in the byte							

Bit 7 ÷ 0: bit mask used by trigger.
Bit 12 ÷ 8: byte offset in the device STATE (numeration starts from 1).
Bit 14 ÷ 13: Not Used.
Bit 15: if 0 means OR function among selected bits (mask), if 1 means AND function.

Example 1:
To configure data logger trigger type to stop when at least one of the listed conditions occur (L tripped, S tripped, I tripped and G tripped) the value to write is:

Bit 7 ÷ 0 = 00101011 (1 in correspondence of desired bits).
Bit 14 ÷ 8 = 00001111 = 15 (byte containing conditions is the 15th of STATE).
Bit 15 = 0 (OR function).

Therefore Data logger Trigger Type = 0x0F2B

Example 2:
To configure data logger trigger type to stop when all the listed conditions occur (UV Timing, RV Timing) the value to write is:

Bit 7 ÷ 0 = 10000010 (1 in correspondence of desired bits).
Bit 14 ÷ 8 = 0001001 = 9 (byte containing conditions is the 15th of STATE).
Bit 15 = 1 (AND function).

Therefore Data logger Trigger Type = 0x8982

11.2.3.5 Stop delay setting

Both by HMI and by the system it is possible to set, through a datalogger stop delay parameter, the stop delay in the range 0.00 [s] at 10.00 [s] with step of 0.01 [s].

11.2.4 Available commands for the datalogger

It is possible to send the following commands to the datalogger activation/disactivation

- **Restart trigger**: after this command the dataloger trigger is reset.
- **Stop acquisition**: after this command the possible recording of the datalogger is stopped

In case there is an opening these commands are not accepted and will be reply exception BUSY.

11.2.5 Functioning description

When the functionality is activated, the measures are continuously recorded and with a frequency set in a FIFO memory.

The recording will end after a stop delay setted according to the trigger event.

⚠ The recording will end 10 ms after a trip.

The following recording will be activated after a Restart trigger command.

The recording will end also after a Stop Datalogger command.

If the parameters relevant to the datalogger are changed while it is active, the recording will be cleared and a new recording will start according to the new parameters.

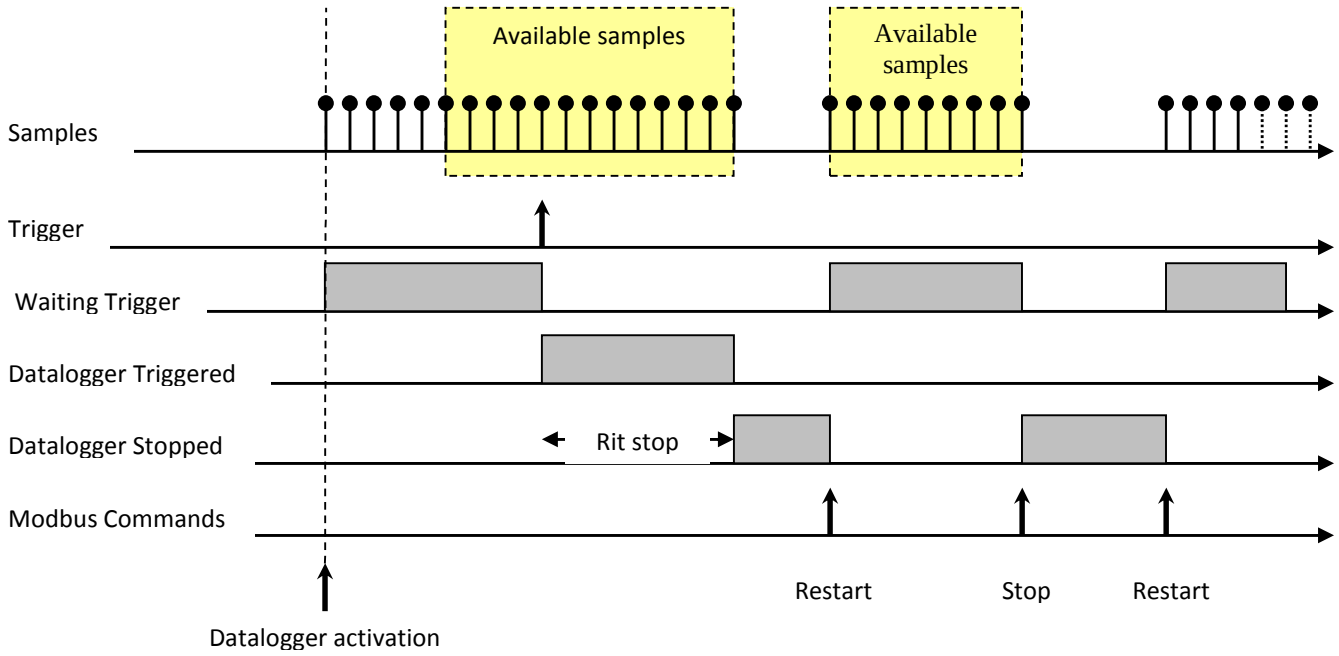


Figure 7 Example of stop datalogger for trigger or for stop command and restart trigger command

11.3 MEASURE HISTORY DATA STRUCTURE

The measure history log (8.13) contains the following information:

- Marker
- History code
- Saving period
- Day
- Hour + minute
- Total mean active power
- Maximum current
- Phase of Maximum current (IA, IB)
- Maximum Voltage

The Marker (word length) is a general code for all non-volatile memory structure used to distinguish valid data (marker = 0x0000) from not valid data (marker ≠ 0x0000)

The history code has 3 types of recorded data:

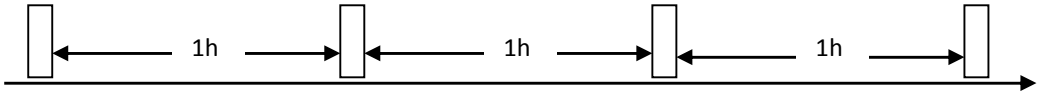
Nr. 0 = Normal record.
Nr. 1 = First record after a supply power-up.
Nr. 2 = First record after a saving period change.

Saving period mean, in the case nr.0 and nr.2, the elapsed time in minutes from previous record.
In case nr.1 an almost empty structure is recorded only to show power supply returns; only Marker and History code have mean.

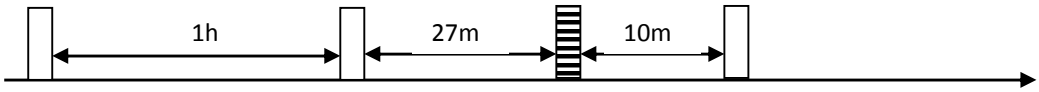
Day, hour and minutes are the time-stamp of structure recording time.

Could take place the following situations:

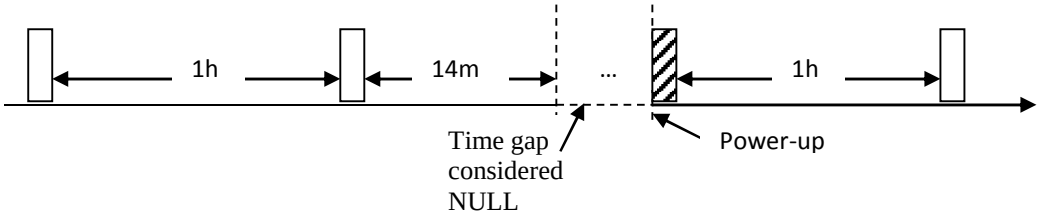
1. Normal situation (history code 0) with saving period = 1hour:



2. For e.g. after 27minutes from last recording time the Saving period is changed to 10minutes (history code 2):



3. For e.g. after 14minutes from last recording time there is an auxiliary power supply failure and then a new power-up (history code 1):



The striped histograms are those that match with historical code different from “normal”

11.4 RELAY FUNCTIONALITY

In PARAMETERS CONFIGURATION **Error! Reference source not found.**some parameters are present that must be opportunely programmed to carry out the activation funtions of P1 ÷ P4 relay (PR120/K).

In presence of the contact module (4 relay) the relevant relays can be managed as shown: it is possible an event (a specific state situation) following up to activate with the desired relay, the desired relays in an independent way. Following the functionality is shown.

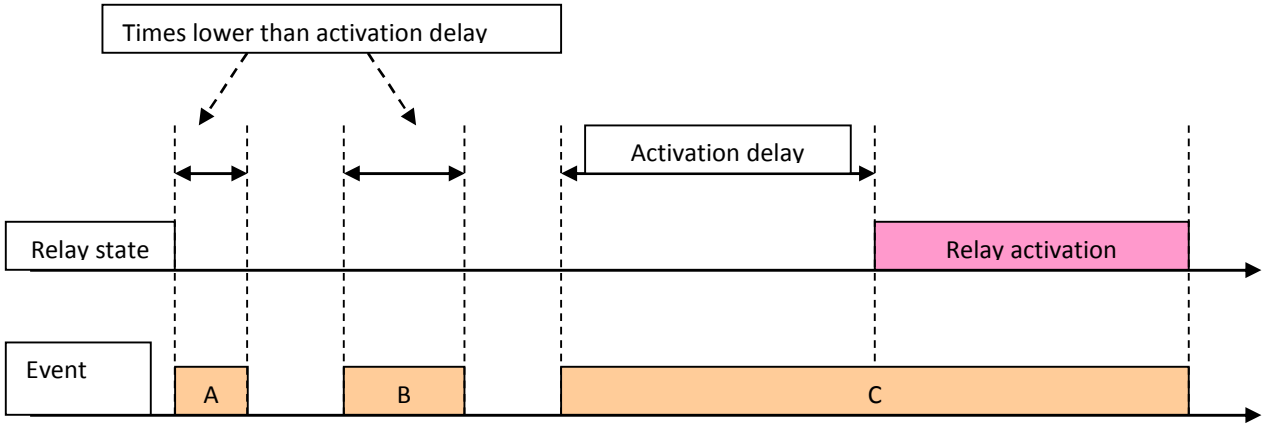


Figure 8 Relay functionality

In figure 3 situations A, B, C are shown with the activation condition occurred, in situations A and B this doesn't last for a time higher than the activation delay, therefore the relay is not activated: in situation C the relay is activated after a delay set and disactivated immediately (with a minimum selectable activation time) at the lacking of the condition of valid activation.
In the following figure the situation of the operation of the minimum time of relay activation is shown when the activation event becomes not checked before the expiring of this time.
Note: the minimum activation time is selectable only for activation functions CUSTOM

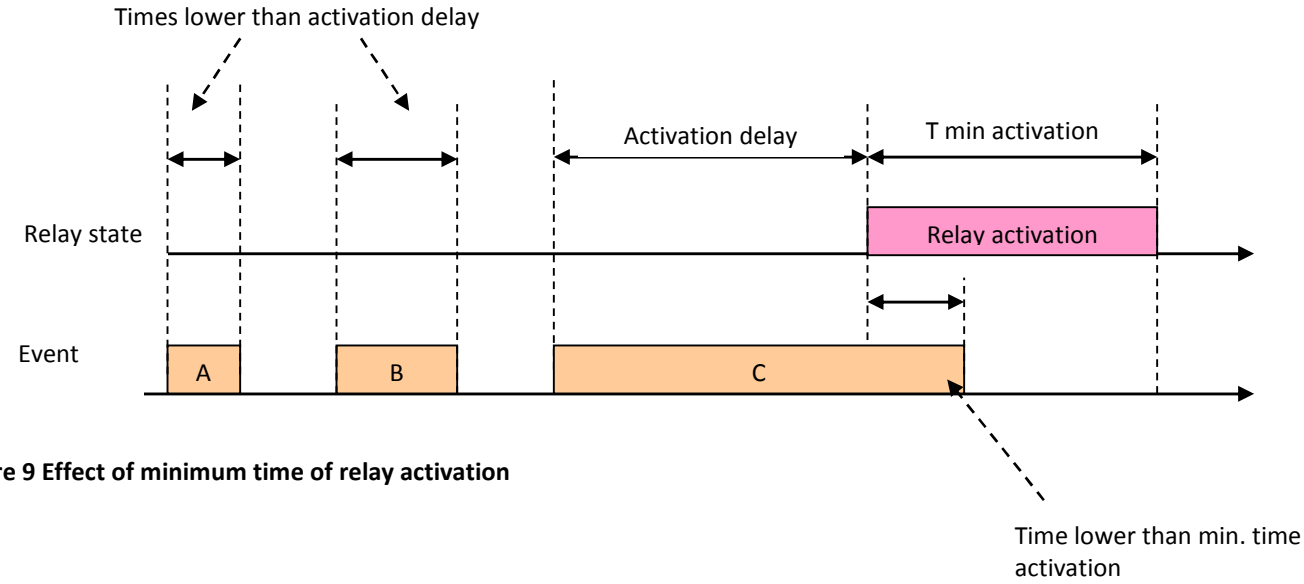


Figure 9 Effect of minimum time of relay activation

11.4.1 Settings of relay fucntionality of the signaling module

In PARAMETERS CONFIGURATION the configuration parameters, described below, of the relay are present.

11.4.1.1 Settings of the configuration of relay contacts

In PARAMETERS CONFIGURATION in the record P relays Contact Config it is possible to choose for each relay if the contact may be normally open or normally close and if it may have the latched.

11.4.1.2 Setting of the activation relay function

By HMI the relevant activation function for each relay may be programmed choosing it among a list of standard functions while by the system other more complex functions said custom may be programmed.

11.4.1.2.1 Standard function of relay activation

By HMI one of the following standard functions can be programmed:

0. None (nessuna attivazione)
1. L prealarm
2. L timing
3. S timing
4. L trip
5. S trip
6. I trip
7. G trip
8. Any trip

that clearly define which event determines the relay activation (or the disactivation if the relay is defined as normally close).

11.4.1.2.2 Custom function of relay activation

By the system, it is possible, besides the limits shown above, select the activation function more sophisticated in the following way:

Writing in the record '*namerelay* Function' in PARAMETERS CONFIGURATION a value included between 0 and 8, one of the 9 types of the above standard functions will be set, writing a higher value the function will be considered custom type and explained as follows:

Bit of function relay															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
OR AND	Minimum activation T		Byte placement in STATEE					Bits mask to be monitored in the trigger							

Bit 7 ÷ 0: bit mask used in the activation relay function.
Bit 12 ÷ 8: byte offset in the device STATE (numbering starts from 1).
Bit 14 ÷ 13: minimum activation time of the relay (00 = none, 01 = 50ms, 10 = 100ms, 11 = 200ms).
Bit 15: if 0 it means OR function among the selected bits, if 1 it means AND function among the selected bits.

Example 1:

To configure the activation function in order that the relay will activate when even one of the listed conditions occur : L tripped, S tripped, I tripped e G tripped, the value to write is:

Bit 7 ÷ 0 = *00101011 (1 in correspondence of the desired bit).*
Bit 14 ÷ 8 = *00001111 = 15 (byte containing conditions is the 15th of STATE (numbering starts from 1).*
Bit 15 = 0 (OR function).

Therefore relay function = 0x0F2B

Example 2:

To configure the trigger in order that the datalogger will stop when simultaneously the listed conditions occur: UV Timing, RP timing, the value to write is:

Bit 7 ÷ 0 = 10000010 (1 in correspondence of desired bit).
Bit 14 ÷ 8 = 0001001 = 9(byte containing conditions is the 9th of STATE (numbering starts from 1).
Bit 15 = 1 (AND function).

Therefore Datalogger Trigger Type = 0x8982

11.4.1.3 Setting of activation delay

Both by HMI and by system it is possible to set, through parameter '*namerelay* Delay' the activation delay in range 0.00 [s] to 100.00 [s] with step of 0.01 [s].

11.4.1.4 Reset of signallings

As shown in para. COMM, it is provided the reset signalling command following up the contacts are placed to their rest state (open or closed according to the programming); if the function of the relay activation is still valid, the reset command causes no changes of the same relay state.

11.5 SIGNALLING MODULE INPUT FUNCTIONALITY

In the signalling module there i also the input with configurable functionality.

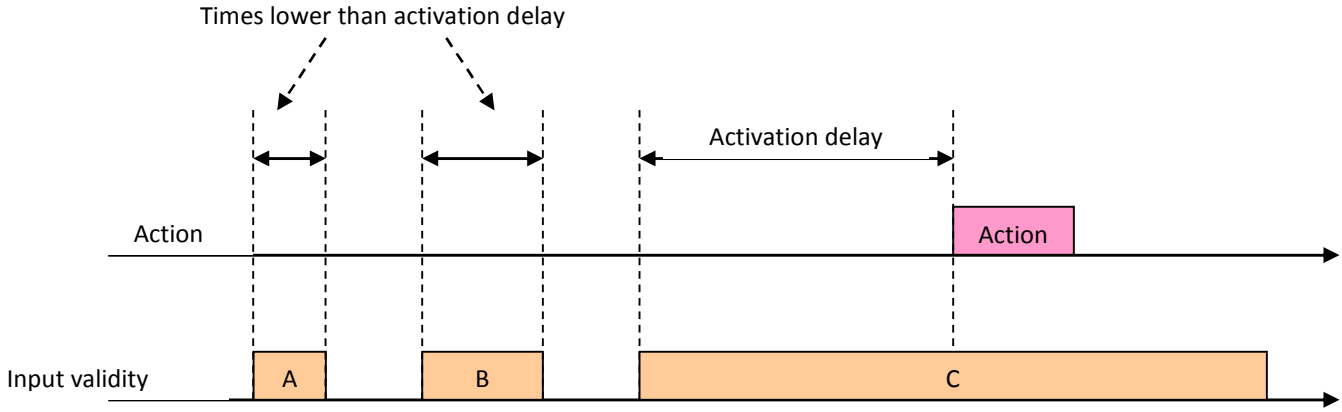


Figure 10 Signalling module input functionality

In figure are shown 3 situations (A, B, C) with the input state valid.
In situations A and B the input is not valid for a time higher than the activation delay therefore the action associated has not occurred; instead in situation C the action begins after the set delay.

11.5.1 Settings of input signalling module

In PARAMETERS CONFIGURATION **Error! Reference source not found.**the parameters configurations of this input are present.

11.5.1.1 Settings of input configuration

In Programmable Input Config of PARAMETERS CONFIGURATION it is possible to select the level at which to consider active the input:

1. low active input
2. high active input

11.5.1.2 Settings of input function (ACTION)

In Programmable Input Function of PARAMETERS CONFIGURATION it is possible to select the action associated to the input, that is the action that after the programmed delay occurs after the activation (high or low) of the input.
It's possible to select one of the following actions:

1. Generic : No specific action is associated to the input that can be read in the state as generic input
2. Trip test: when the input is active for the specified delay a trip test is carried out
3. Trip reset: when the input is active for the specified delay a trip reset is carried out
4. Set B: when the input is active for the specified delay the SET B is enabled
5. Dial Local: when the input is active for the specified delay the local mode of the dialogue is forced
6. Signalling Module Reset: when the input is active for the speficied delay the relay state is reset
7. Energy Reset: when the input is active for the specified delay the energy meters are reset

11.5.1.3 Setting of input activation delay

It' s possible to set, by the parameter 'Programmable Input Delay' the activation delay in the range 0.00 [s] to 100.00 [s] with step of 0.01 [s].

11.6 CB STATE INFORMATION

The device using the following dedicated input reports CB state:

- CB open
- CB close
- CB connected/withdrawn
- Springs charged

The device filters and checks CB state producing the following information:

- CB open/close
- CB state undefined
- CB state error
- CB connected/withdrawn
- Springs charged/discharged

The following table shows the information on CB:

State	Value		Notes
	0 = Open	1 = Close	
CB open/close	Input CB open = 1 Input CB close = 0 NO flowing current	Input CB open = 0 Input CB close = 1	The state of inputs open and close has to remain steady for at least 30 ms

State	Value		Notes
	0 = Defined	1 = Undefined	
CB undefined	Input CB open = 1 Input CB close = 0 NO flowing current Or Input CB open = 0 Input CB close = 1	Input CB open = Input CB close	The state of inputs open and close has to remain steady for at least 30 ms

State	Value		Notes
	0 = No error	1 = CB error	
CB error	Other chases	Input CB open = 1 Input CB close = 0 Current flowing	The state of inputs open and close has to remain steady for at least 30 ms

State	Value		Notes
	0 = withdrawn	1 = connected	
CB withdrawin/connected	Input CB connected = 0	Input CB connected = 1	The input has to remain steady for at least 1000 ms

State	Value		Notes
	0 = discharged springs	1 = charged springs	
Springs charged/discharged	Input charged springs = 0	Input charged springs = 1	The input has to remain steady for at least 200 ms

11.7 STATISTICAL DATA

Devices produces some statistical data relevant to system bus communication and to CB operations, in particular:

1. **<u>communication statistical data</u>**
   a. received messages nr.
   b. Received messages ns. with crc error
   c. Set messages nr.
   d. Slave Busy exception responses nr.
   e. Total exception responses nr.

   Must be: a = b + c + nr. Broadcast messages

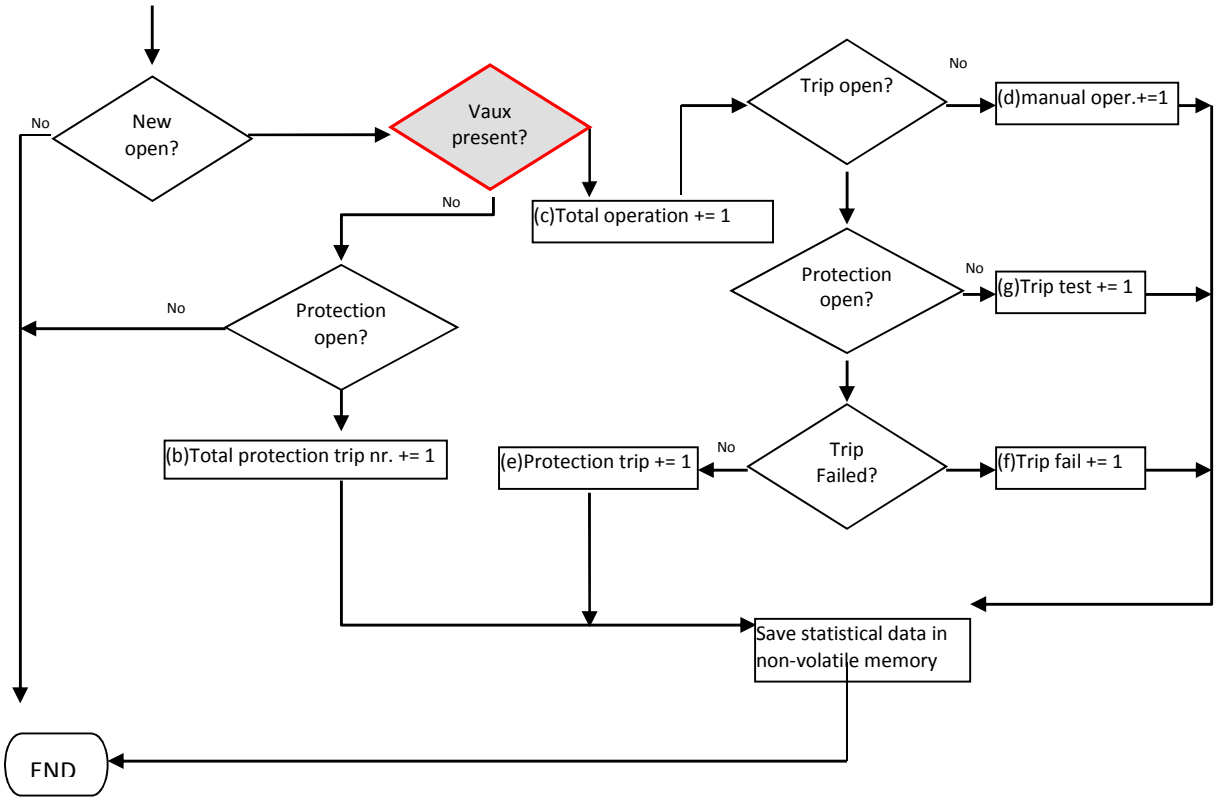
Data described above are NOT updated in self-supply device mode.

⚠ **There is a copy of each bus for the statistic communication data in order that the cancelling of the same will not compromise the reading by other bus.**

---

2. **<u>CB operation statistical data</u>**
   a. Contact wear
   b. Total protection trip number
3. **<u>CB operation statistical data NOT updated in self-supply device mode</u>**
   c. Total operation nr.
   d. Manual operation nr.
   e. Protection trip nr.
   f. Protection trip fail nr.
   g. Trip test nr.

The relationship between them: c = d + e + f + g , b ≥ e + f.
The following diagram shows the CB statistical data calculation method:



11.8 RELAYS YO AND YC

By proper commands (CB Open and CB Close) it is possible to operate on relays YO and YC present on dialogue unit.
In case of command acceptance, the interested relay is closed for 120 ms. The following table shows the checks carried out for the acceptance of the commands and the relevant activation.

Command	Acceptance conditions	Relay YO	RelayYC	Notes
CB Open	CB connected Test Unit not connected	It is excited for 120 ms		In case the acceptance conditions are not verified the exception ILLEGAL FUNCTION will be give back
CB Close	CB connected CB not undefined Test Unit not connected		It is excited for 120 ms	

The relay YO is controlled also after a back up protection (the CB is closed also after an open command); in this case the relay YO is controlled with an excitation (120 ms)–idle (50 ms) up to the CB is not open.

11.9 GESTIONE COMANDI

11.9.1 Command execution conditions:

To the condition below reported must be appended:

1. By **external bus** the commands are accepted only in **remote** operation device mode.
2. With Test unit connected only CB OPEN command is accepted

Command type	Action	Acceptance conditions	Notes
Dummy command	No action	Always accepted	
CB Open	Active for 200 ms output YO	CB connected and opening or closing not executing	This is the only command accepted when the unit test is connected.
CB Close	Active for 200 ms output YC	CB connected, CB open, state CB **not** undefined and open and close command not executing	
Reset CB	Reset trip state bits	Always accepted	
Start Autotest Display Led	Carry out display and led tests	Always accepted	
Start Autotest Module Contacts	Carry out module contact tests	Always accepted	
Trip test	Carry out a trip test	I > 0,05 In	
Trip reset	Abort trip state bits	Always accepted	
Wink toggle command	Commute wink state of the unit (backlight wink)	Always accepted	
Reset signalling	Reset the signalling module and unit master on local bus	Always accepted	

Table 14 COMMAND EXECUTION CONDITIONS

11.10 MEASURE LIMITS AND REPRESENTATION

Measure	Special value	Description	Modbus	Local Display
Currents	Not available	CB state Inaccuracy / current presence	0xFFFFFFFF	_ _ _
	Too low	I < Imin	0	•••
	Saturation	I > Imax	Imax	I > xxx A
Gint Current	Not available	CB state Inaccuracy / current presence IG > IGmax	0xFFFFFFFF	_ _ _
	Too low	IG < IGmin	0	•••
Max current polarity	Not available	CB state Inaccuracy / current presence, tutte le I < Imin	0 (enumerativo)	_ _ _
Voltage	Not available	Voltager Module Absent	0xFFFF	_ _ _
	Too low	V < Vmin	0	•••
	Saturation	V > Vmax	Vmax	V > xxx V
Active Power	Not available	Voltager Module Absent, CB state Inaccuracy / current presence, I < Imin, V < Vmin	0x7FFFFFFF	_ _ _
	Too low	| P | < Pmin	0	•••
	Positiv Saturation	P > Pmax	Pmax	P > xxx kW
	Negativ Saturation	P < - Pmax	- Pmax	P < xxx kW
Active Energy	Positiv Saturation	$E > 2^{31}-1$	0x7FFFFFFF	E > xxx kWh
	Negativ Saturation	$E < -2^{31}$	0x80000000	E < xxx kWh
Contact wear	Saturation	CW > 100%	65000	100%

Legend:
Imin = 0,05 In
Imax = 10 In
IGmin = 0,05 In
IGmax = 10 In
Vmin = 5,7 V
Vmax = 1000 V
Pmin = 0,5 In * 5,7 V
Pmax = 12 In * 1000 V

Note: It is advisable to use the visualization shown in column “local Display” also on remote visualization devices.

11.11 CONTACT WEAR

The contact wear is calculated as the usury sum owed at every single CB open and it’s explicit in % (0 ÷ 100[%]):
I’s available in format 0 ÷ 65000 (0 = 0%, 65000 = 100%), therefore to obtain the percentage is necessary to divide the value for 650.

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