

Technical University of Denmark

31342 Introduction to Programmable Logic Controllers

Exercise 10

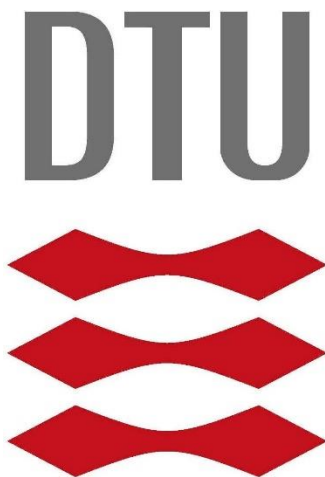
Alarms

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Part 1: The implementation of a test program:

The signals for the specified alarm conditions in the Table 1¹ are implemented by using structural text. The implementation is given in the Figure 1.

Signal Name	Type	Alarm Condition
A	Boolean	TRUE
f1	Integer	> 10
f2	Integer	< -15
g1	Float	10 % deviation from 20
g2	Float	Rate of change > 0.5

Table 1: Signals for the specified alarm conditions

```

0001 PROGRAM PLC_PRG
0002 VAR
0003     swA: BOOL;
0004     swf1: BOOL;
0005     swf2: BOOL;
0006     swg1: BOOL;
0007     swg2: BOOL;
0008
0009     A: BOOL;
0010     f1: INT;
0011     f2: INT;
0012     g1: REAL;
0013     g2: REAL;
0014     tg1: TON;
0015 END_VAR
0016
0001 IF swA THEN
0002     A:=TRUE;
0003 ELSE
0004     A:=FALSE;
0005 END_IF;
0006
0007 IF swf1 THEN
0008     f1:=15;
0009 ELSE
0010     f1:=5;
0011 END_IF;
0012
0013 IF swf2 THEN
0014     f2:=-20;
0015 ELSE
0016     f2:=-10;
0017 END_IF;
0018
0019 IF swg1 THEN
0020     g1:=22.2;
0021 ELSE
0022     g1:=20;
0023 END_IF;
0024
0025 tg1(IN:=TRUE, PT:=#1h);
0026
0027 IF swg2 THEN
0028     g2:=TIME_TO_REAL(tg1.ET)/1000;
0029 ELSE
0030     g2:=TIME_TO_REAL(tg1.ET)/10000;
0031 END_IF;
  
```

Figure 1: The structural text for the implementation

¹ Adapted from the 10th exercise description file.

The assignment of the signals A, f1, f2, and g1 is straightforward; on the other hand, the assignment of the signal g2 looks complicated. Since an elapsed time (ET) in a TON type timer is an increasing time function, the rate of change in ET can be modified by dividing. When it is divided by 1000, its rate of change is larger than 0.5; and when it is divided by 10000, its rate of change is smaller than 0.5.

The visualization of the alarms is given in the Figure 2.

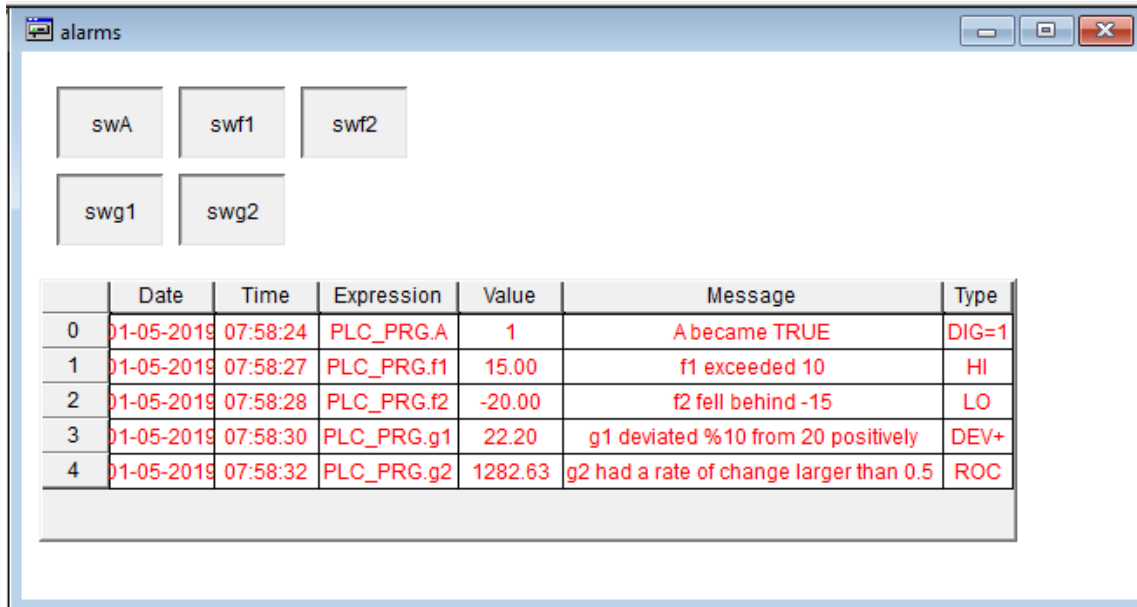


Figure 2: The visualization of the alarms

Each button on the visualization triggers the alarm that is indicated with its name. When a button is pressed, a message about the corresponding alarm will be shown, the alarm information will be present in the alarm table, and the information will be saved in a log file.

The listing of the log file uploaded with name *ex10_part1_logFile* is given in the Figure 3.

```
1556740699;71899134;01-05-2019;07:58:19;INTO;PLC_PRG.g2;ROC;0.5;;0; 126.97;DEFAULT;0;g2 had a rate of change larger than 0.5 ;
1556740704;71904735;01-05-2019;07:58:24;INTO;PLC_PRG.A;DIG=1;;; 1.00;DEFAULT;0;A became TRUE;
1556740707;71907498;01-05-2019;07:58:27;INTO;PLC_PRG.f1;HI;10;;; 15.00;DEFAULT;0;f1 exceeded 10;
1556740708;71908963;01-05-2019;07:58:28;INTO;PLC_PRG.f2;LO;-15;;; -20.00;DEFAULT;0;f2 fell behind -15;
1556740710;71910260;01-05-2019;07:58:30;INTO;PLC_PRG.g1;DEV+;10;20;; 22.20;DEFAULT;0;g1 deviated %10 from 20 positively;
1556740712;71912065;01-05-2019;07:58:32;INTO;PLC_PRG.g2;ROC;0.5;;0; 1282.63;DEFAULT;0;g2 had a rate of change larger than 0.5 ;
1556740741;71941953;01-05-2019;07:59:01;INTO;PLC_PRG.g2;ROC;0.5;;0; 1312.51;DEFAULT;0;g2 had a rate of change larger than 0.5 ;
1556740743;71943179;01-05-2019;07:59:03;INTO;PLC_PRG.g1;DEV+;10;20;; 22.20;DEFAULT;0;g1 deviated %10 from 20 positively;
1556740743;71943803;01-05-2019;07:59:03;INTO;PLC_PRG.f2;LO;-15;;; -20.00;DEFAULT;0;f2 fell behind -15;
1556740744;71944421;01-05-2019;07:59:04;INTO;PLC_PRG.f1;HI;10;;; 15.00;DEFAULT;0;f1 exceeded 10;
1556740745;71945238;01-05-2019;07:59:05;INTO;PLC_PRG.A;DIG=1;;; 1.00;DEFAULT;0;A became TRUE;
```

Figure 3: The listing of the log file from the 1st part

It can be seen from the listing that it consists of the stamp of the runtime system, (?), the date, the time when the alarm is activated, acknowledgment type, the variable expression of the alarm, the alarm type, the specifications for the corresponding alarm, the variable value, the class of the alarm, the priority of the alarm, and the message of the alarm when the alarm is activated; respectively.

For example, the alarm for the A signal is triggered twice at 07:58:24 and at 07:59:05. And its message is *A became TRUE*.

Part 2: An application of alarms for the implementation of the 8th exercise:

The current temperature value of the room is used to trigger an alarm if its value exceeds 21.5 °C. And another alarm is set to the on-time of the light in the room. If the light is on more than 1 minute, the alarm will be activated. The timing is achieved by a TON timer with inputs *gr* (the green light signal on the control box indicates the status of the light in the room) and *t#60s*.

The visualization of the alarms is given in the Figure 4.

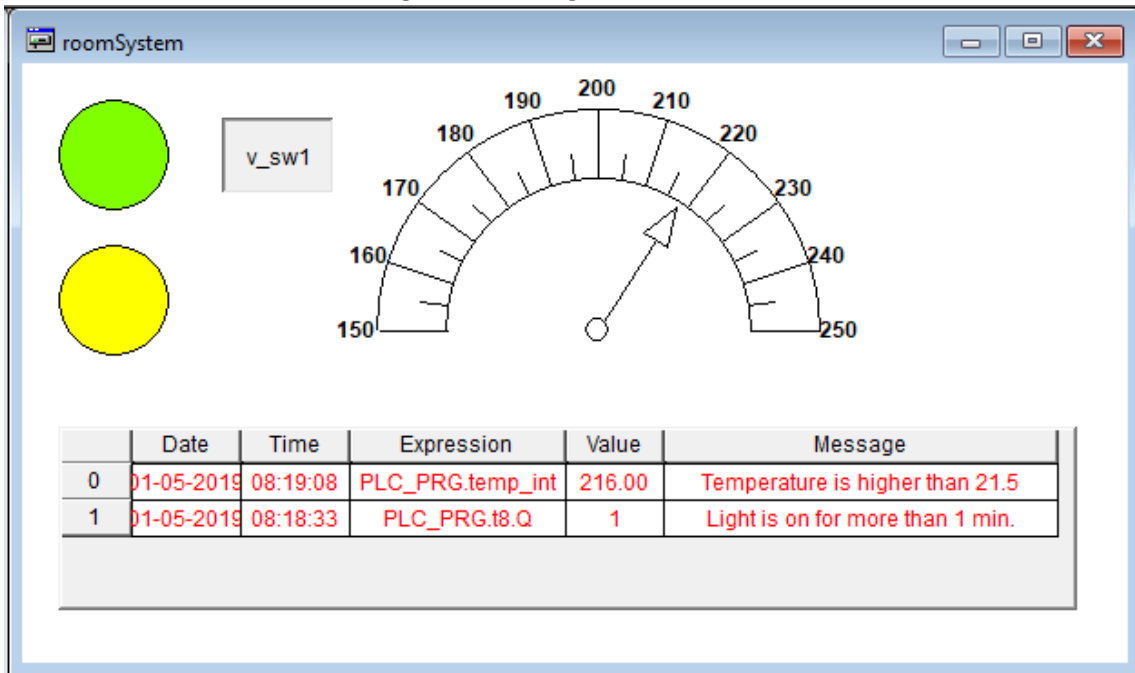


Figure 4: The visualization of the alarms

Note: The temperature values are shown as multiplied by 10, since they are stored as so in the 8th exercise.

The information of alarms is logged to a file named *ex10_part2_logFile*; and the listing of the log file is given in the Figure 5.

```
1556741913;73113077;01-05-2019;08:18:33;INTO;PLC_PRG.t8.Q;DIG=1;;; 1.00;DEFAULT;0;Light is on for more than 1 min.;
1556741925;73125987;01-05-2019;08:18:45;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
1556741948;73148488;01-05-2019;08:19:08;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
1556741982;73182470;01-05-2019;08:19:42;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
1556742016;73216379;01-05-2019;08:20:16;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
1556742050;73250641;01-05-2019;08:20:50;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
1556742084;73284548;01-05-2019;08:21:24;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
1556742085;73285838;01-05-2019;08:21:25;INTO;PLC_PRG.t8.Q;DIG=1;;; 1.00;DEFAULT;0;Light is on for more than 1 min.;
1556742118;73318518;01-05-2019;08:21:58;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
1556742152;73352519;01-05-2019;08:22:32;INTO;PLC_PRG.t8.Q;DIG=1;;; 1.00;DEFAULT;0;Light is on for more than 1 min.;
1556742153;73353799;01-05-2019;08:22:33;INTO;PLC_PRG.temp_int;HI;215;;; 216.00;DEFAULT;0;Temperature is higher than 21.5;
```

Figure 5: The listing of the log file from the 2nd part

The construction of the log file for the 2nd part is the same as the one in the 1st part.

It can be seen from the log file that the alarm corresponding to the on-time of the light is activated three times; and the alarm corresponding to the temperature values is activated eight times.