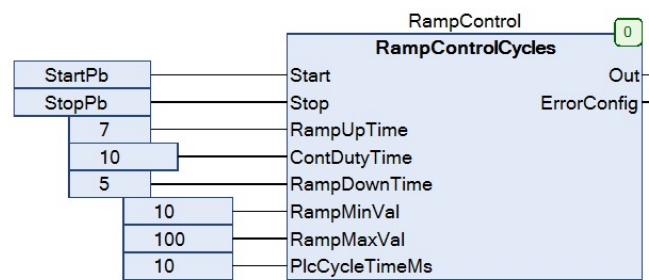
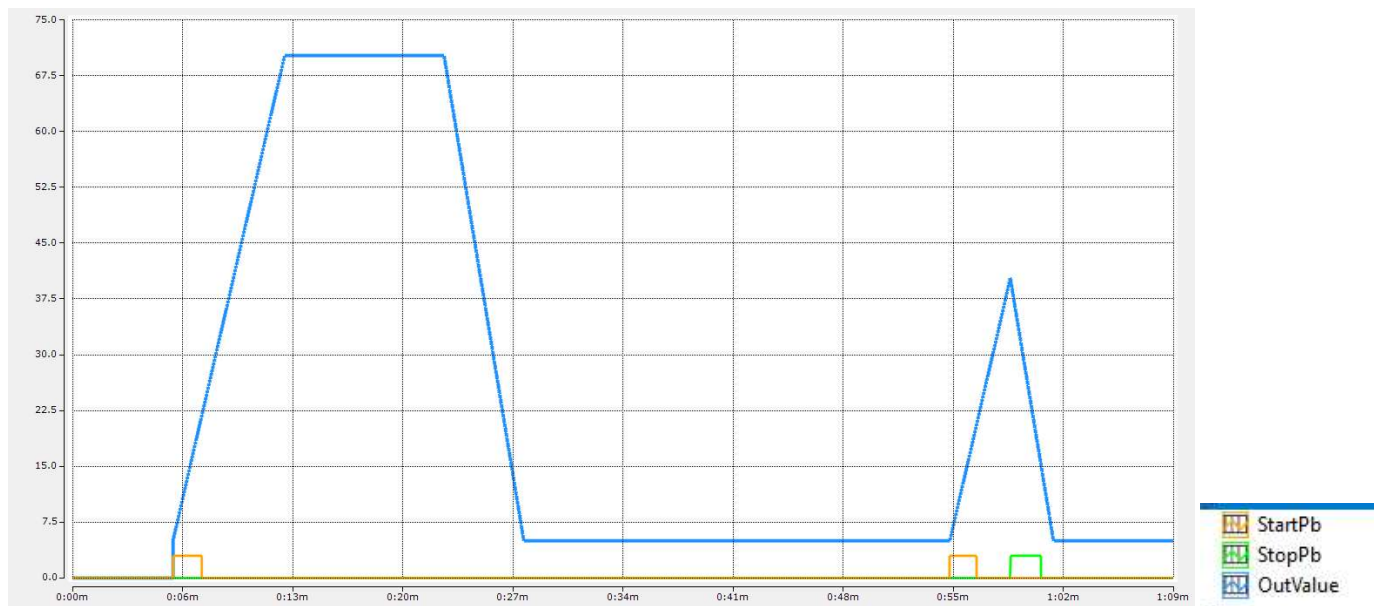


Speed Ramp Control

Program for generation of speed curve ramps according to given parameters in seconds.



Version 1 – Using cycles counting method:

```

1  FUNCTION_BLOCK RampControlCycles
2  VAR_INPUT
3      Start          :   BOOL;
4      Stop           :   BOOL;
5      RampUpTime     :   UINT;           // ramp up time in seconds
6      ContDutyTime    :   UINT;           // continuous duty time in seconds
7      RampDownTime   :   UINT;           // ramp down time in seconds
8      RampMinVal     :   REAL;           // output min value
9      RampMaxVal     :   REAL;           // output max value
10     PlcCycleTimeMs  :   UINT;           // PLC cycle in milliseconds
11 END_VAR
12 VAR_OUTPUT
13     Out              :   REAL;
14     ErrorConfig      :   BOOL;
15 END_VAR
16 VAR
17     rtStart          :   R_TRIG;
18     rtStop           :   R_TRIG;
19     SeqStep          :   (IDLE, INIT, RAMP_UP, CONTINUOUS_DUTY, RAMP_DOWN);
20     RampUpPoints     :   UINT;
21     RampDownPoints   :   UINT;
22     ContDutyPoints   :   UINT;
23
24     RampUpValRes     :   REAL;
25     RampDownValRes   :   REAL;
26     RampUpCycles     :   UINT;
27     RampDownCycles   :   UINT;
28     ContDutyCycles   :   UINT;
29
30     InitBit          :   BOOL:=TRUE;
31 END_VAR
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```

34     InitBit          := FALSE;
35 END_IF
36
37 // detect pushbuttons action
38 rtStart(CLK:=Start);
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40
41 IF rtStart.Q AND SeqStep=IDLE AND NOT ErrorConfig THEN
42     SeqStep := INIT;
43 END_IF
44
45 IF rtStop.Q AND (SeqStep=CONTINUOUS_DUTY OR SeqStep=RAMP_UP) THEN
46     SeqStep := RAMP_DOWN;
47 END_IF
48
49
50 CASE SeqStep OF
51     IDLE:
52         ;
53     INIT:
54         Out          := RampMinVal;
55         RampUpCycles := 0;
56         ContDutyCycles := 0;
57         RampDownCycles := 0;
58         SeqStep      := RAMP_UP;
59
60     RAMP_UP:
61         Out := Out + RampUpValRes;
62         RampUpCycles := RampUpCycles+1;
63         IF RampUpCycles > RampUpPoints THEN SeqStep := CONTINUOUS_DUTY; END_IF
64
65     CONTINUOUS_DUTY:
66         ContDutyCycles := ContDutyCycles+1;
67         IF ContDutyCycles > ContDutyPoints THEN SeqStep := RAMP_DOWN; END_IF
68
69     RAMP_DOWN:
70         IF (Out - RampDownValRes) > RampMinVal THEN
71             Out := Out - RampDownValRes;
72         ELSE
73             Out := RampMinVal;
74         END_IF
75
76         RampDownCycles := RampDownCycles+1;
77         IF RampDownCycles > RampDownPoints THEN SeqStep := IDLE; END_IF
78 END_CASE
79

```

Version 2 – Using timers:

```

1  FUNCTION_BLOCK RampControlTimers
2  VAR_INPUT
3      Start          : BOOL;
4      Stop           : BOOL;
5      RampUpTime     : UINT;           // ramp up time in seconds
6      ContDutyTime   : UINT;           // continuous duty time in seconds
7      RampDownTime   : UINT;           // ramp down time in seconds
8      RampMinVal     : REAL;           // output min value
9      RampMaxVal     : REAL;           // output max value
10     PlcCycleTimeMs  : UINT;           // PLC cycle in milliseconds
11 END_VAR
12 VAR_OUTPUT
13     Out              : REAL;
14     ErrorConfig      : BOOL;
15 END_VAR
16 VAR
17     rtStart          : R_TRIG;
18     rtStop           : R_TRIG;
19     SeqStep          : (IDLE, INIT, RAMP_UP, CONTINUOUS_DUTY, RAMP_DOWN);
20
21     RampUpValRes     : REAL;
22     RampDownValRes   : REAL;
23
24     InitBit          : BOOL:=TRUE;
25     tonRampUp        : TON;
26     tonContDuty      : TON;
27     tonRampDown      : TON;
28 END_VAR
29

```

```

1  (*
2  This FB generates output signal ramps including three areas:
3  - up ramp (in seconds)
4  - continuous duty (in seconds)
5  - down ramp (in seconds)
6
7  Start cycle with <Start> pulse.
8  The output signal can be stopped with <Stop> pulse during ramp up and cont. duty cycle.
9  It ramps down in that case to avoid immediate stop (any damage of the controlled device).
10 *)
11
12 IF InitBit THEN
13     // check input parameters for unvalid values
14     IF PlcCycleTimeMs=0 OR RampUpTime=0 OR RampDownTime=0 THEN
15         ErrorConfig := TRUE;
16     ELSE;
17         ErrorConfig := FALSE;
18         (*init calculations*)
19         // output value resolution for each cycle during ramp up
20         RampUpValRes := (RampMaxVal - RampMinVal) / ((TO_REAL(RampUpTime) / (TO_REAL(PlcCycleTimeMs) / 1000.0)));
21         // output value resolution for each cycle during ramp down
22         RampDownValRes := (RampMaxVal - RampMinVal) / ((TO_REAL(RampDownTime) / (TO_REAL(PlcCycleTimeMs) / 1000.0)));
23     END_IF;
24     InitBit      := FALSE;
25 END_IF
26
27 // detect pushbuttons action
28 rtStart(CLK:=Start);
29 rtStop(CLK:=Stop);
30
31 IF rtStart.Q AND SeqStep=IDLE AND NOT ErrorConfig THEN
32     SeqStep := INIT;
33 END_IF
34
35 IF rtStop.Q AND (SeqStep=CONTINUOUS_DUTY OR SeqStep=RAMP_UP) THEN
36     SeqStep := RAMP_DOWN;
37 END_IF
38
39
40 CASE SeqStep OF
41     IDLE:
42         ;
43     INIT:
44         Out                := RampMinVal;
45         tonRampUp.IN       := FALSE;
46         tonContDuty.IN     := FALSE;
47         tonRampDown.IN     := FALSE;
48         tonRampUp.PT       := UINT_TO_TIME(RampUpTime * 1000);
49         tonContDuty.PT     := UINT_TO_TIME(ContDutyTime * 1000);
50         tonRampDown.PT     := UINT_TO_TIME(RampDownTime * 1000);
51
52         SeqStep            := RAMP_UP;
53
54     RAMP_UP:
55         tonRampUp.IN:= TRUE;
56         Out := Out + RampUpValRes;
57         IF tonRampUp.Q THEN
58             SeqStep      := CONTINUOUS_DUTY;
59             tonRampUp.IN  := FALSE;
60         END_IF
61
62     CONTINUOUS_DUTY:
63         tonContDuty.IN := TRUE;
64         IF tonContDuty.Q THEN
65             SeqStep      := RAMP_DOWN;
66             tonContDuty.IN := FALSE;
67         END_IF
68
69     RAMP_DOWN:
70         IF (Out - RampDownValRes) > RampMinVal THEN
71             Out := Out - RampDownValRes;
72         ELSE
73             Out := RampMinVal;
74         END_IF
75
76         tonRampDown.IN := TRUE;
77         IF tonRampDown.Q THEN
78             SeqStep      := IDLE;
79             tonRampDown.IN := FALSE;
80         END_IF
81 END_CASE
82
83 tonRampUp();
84 tonContDuty();
85 tonRampDown();

```