Utils for Coolmay FX3G PLC

Description

This library provides useful functions

SCALE_AI

Function to scale AI input into mesured values. For 4-20ma Inputs only.

Variable	Scope	Type	Description
AINum	INPUT	ANY16	Number of AI 0-16
Min	INPUT	ANY16	Minimum of measured unit
Max	INPUT	ANY16	Maximum of measured unit
FilterTime	INPUT	ANY16	Filter input by time. From 1ms to 60ms. Default 10ms.
FilterNum	INPUT	ANY16	Filtering cycles, default is 100 (range 2~20000), data can't be equal to or less than 0. One PLC scan cycle sample one time and change the 1st analog input value for one time. The larger value is, the result is more stable
ValueOut	OUTPUT	ANY16	Scaled value
ErrWire	OUTPUT	Bit	Wire out error
ErrLimit	OUTPUT	Bit	Input values error. Minimum value is more than maximum.

Let's say you have connected 4-20mA pressure sensor at AI0 (AD0). that sensor measure range is 0-16 bar. You want to convert values on that analog input to bars with precision of 0.1.

First declare function block.

```
VAR
    fbScale : SCALE_AI;
    AI0_Pressure: INT;
END_VAR
```

Then in a program

```
fbScale(AINum := 0, Min := 0, Max := 160,
    (* Increas filter for smoother result *)
    FilterTime := 30, FilterNum := 200,
    ValueOut := AI0_Pressure
);
```

```
IF (fbScale.ErrWire) THEN
    (* Wire connection problem *)
END_IF;
```

SACLE

Function to scale one value to another proportionally.

Variable	Scope	Type	Description
`Val`	INPUT	ANY16	Current value
`inLow`	INPUT	ANY16	Current value minimum
`inHigh`	INPUT	ANY16	Current value maximum
`outLow`	INPUT	ANY16	New value minimum
`outHigh`	OUTPUT	ANY16	New value maximum

For example you want to scale 0-100% of a PID regulator to analog output `DA0`

```
D8020 := SACLE(iPIDTask, 0, 100, 0, 4000);
```

`iPIDTask` may have value from 0 to 100, and `D8020` is a system register with control analog output `AD0` which accepts values 0-4000.

SACLE_NL

Function to scale one value to another with none-linear proportions.

Variable	Scope	Type	Description
`PN`	INPUT	ANY16	Number of points
`DTART`	INPUT	ANY16	What device starts to store value
`PV`	INPUT	ANY16	Processed value on X scale to scale to Y

First you have to pack data. Let' say you want to create a 5 point graph started from `D100`. First device will keep number of points, and then points values.

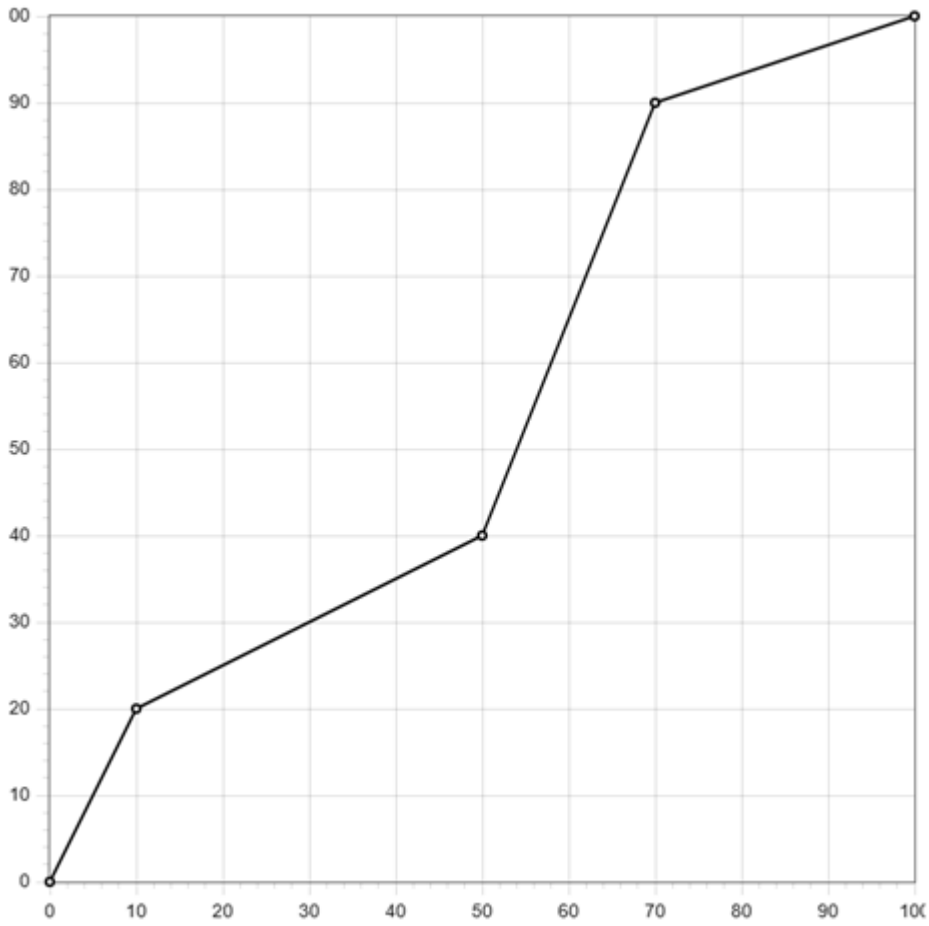
```
D100 = Number of points
D101 = X1
D102 = X2
D103 = X3
D104 = X4
D105 = X5
D106 = Y1
D107 = Y2
```

```
D108 = Y3
D109 = Y4
D110 = Y5
```

Where X1-X5 and Y1-Y5 are not PLC inputs and outputs but point coordinates on X and Y scale. Let's say you have following values.

```
D100 = 5
D101 = 0
D102 = 10
D103 = 50
D104 = 70
D105 = 100
D106 = 0
D107 = 20
D108 = 40
D109 = 90
D110 = 100
```

This means we created a graph



Now we have 4 linear scale lines. Horizontal line is our measured value scale and vertical is what we convert it too. For instance is our PV will be 10 then output will be 20. If PV is 5 then output is 10. When you use Coolmay panel you can use XY Graph element, pass there D100 register and it will draw this graph.

In the code you can use it like this.

```
D200 := SACLE_NL(5, 100, Pv);
```

HYST

On\Off regulator function block.

Variable	Scope	Type	Description
xIn	INPUT	Bit	Enable regulator
iSV	INPUT	ANY16	Set value
iPV	INPUT	ANY16	Processed value
iDV	INPUT	ANY16	Delta
Q	OUTPUT	Bit	ON or OFF

Here is an example how you can get a temperature on an AD0 and use it in hysteresis regulator to control heater on Y0 output.

```
(* Get temperature on AD0 neasure -80.0 to 500.0 *)
fbScale(AINum := 0, Min := -800, Max := 5000,
    ValueOut := AI_Temperature
);

fbHYST(
    xIn := xStart,
    iSV := 255, (* Set value is 25.5 *)
    iPV := AI_Temperature,
    iDV := 2, (* Delat is 0.2 *)
    Q := Y0
);
```

VALVE_3P

Function to control 3 position valve with PID. It is not and a pulse regulator but regulator with constant position search.

> Important !!! **This function required TimeControl library and TCO timer setup**

Variable	Scope	Type	Description
Enable	INPUT	Bit	Start valve control
SV	INPUT	ANY16	Set valve position. It is 0-1000. Best configure PID task output to be 0-1000, If you created 0-100 output for PID, multiply it by 10.

Variable	Scope	Type	Description
TT	INPUT	TIME	Total time it takes for valve to move from fully CLOSED position to fully OPEN. Make it little bit bigger (2%)
DLT	INPUT	ANY16	Hysteresis for regulator. If difference between SV and current position is less that this value we do not move valve. It may reduce number of position changes when it is almost at the spot and save motor resources.
OFF_CLOSE	INPUT	Bit	When we turn off control with Enabled := FALSE should we close valve or leave it in a current position?
OPEN	OUTPUT	Bit	Open valve signal
CLOSE	OUTPUT	Bit	Close valve signal

Here is an example

```
Valve_3p1(
    ENABLE := X0,
    SV := D0,
    TT := T#10s,
    DLT := 50,
    OPEN := Y0,
    CLOSE := Y1
);
```

WORK_LEFT

Function to calculate integer 0-100% how much time is left for timer to finish. Usually used for HMI progress bar.

Variable	Scope	Type	Description
TW	INPUT	ANY16	Timer set time
ET	INPUT	ANY16	Timer elapsed time

Here is an example

```
OUT_T(TRUE, TC10, 10);
D100 := WORK_LEFT(10, TN10);
```

Now D100 will have countdown from 100 to 0.

ISBON \ DISBON

Function to check if a given bit in a WORD or DWORD is on. There is built-in `BON` instruction, but it does not return the value but store it in a parameter you pass to instruction. This is inconvenient. This functions you can use inside expressions.

Variable	Scope	Type	Description
`IN`	INPUT	WORD	The WORD to check
`BN`	INPUT	ANY16	Bit number starts form 0

```
IF ISBON(D100, 2) THEN
    (* The third bit in D100 is ON *)
END_IF;
```

SETB \ DSETB

This function set given bit in a `WORD` (`SETB`) or `DWORD` (`DSETB`) to 1

Variable	Scope	Type	Description
`IN`	INPUT	WORD\DWORD	The WORD to check
`BN`	INPUT	ANY16	Bit number starts form 0

```
(* Sets the third bit in D100 to 1 *)
D100 := SETB(D100, 2)
```

RSTB \ DRSTB

This function reset given bit in a `WORD` (`SETB`) or `DWORD` (`DSETB`) to 1

Variable	Scope	Type	Description
`IN`	INPUT	WORD\DWORD	The WORD to check
`BN`	INPUT	ANY16	Bit number starts form 0

```
(* Resets the third bit in D100 to 0 *)
D100 := RSTB(D100, 2)
```

SRB

This function reset given bit in a `WORD` (`SETB`) or `DWORD` (`DSETB`) to 1

Variable	Scope	Type	Description

Variable	Scope	Type	Description
IN	INPUT	WORD\DWORD	The WORD to check
BN	INPUT	ANY16	Bit number starts form 0
State	INPUT	Bit	What to set 0 or 1 (TRUE or FALSE)

```
D100 := SRB(D100, 2, FALSE);
D100 := SRB(D100, 3, TRUE);
```