Program blocks

MHJ-PLC-Lab-Function-S71500 [FC9000]

MHJ-PLC-Lab-Function-S71500 Properties							
General							
Name	MHJ-PLC-Lab-Function-S71500	**Number**	9000	**Type**	FC	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
▼ Temp		
Value	Byte	
ForCounter	Int	
▼ Constant		
Value_01_DW	DWord	16#1223_5486
Value_02_DW	DWord	16#A6C9_D1F5
▼ Return		
MHJ-PLC-Lab-Function-S71500	Void	

```
0001
0002 #Value:=PEEK(area := 16#82,
0003    dbNumber := 0,
0004    byteOffset := 511);
0005 #Value := #Value + 1;
0006
0007 POKE(area := 16#82,
0008    dbNumber := 0,
0009    byteOffset := 511,
0010    value := #Value);
0011
0012 POKE(area := 16#82,
0013    dbNumber := 0,
0014    byteOffset := 1016,
0015    value := #Value_01_DW);
0016 POKE(area := 16#82,
0017    dbNumber := 0,
0018    byteOffset := 1020,
0019    value := #Value_02_DW);
0020
0021 FOR #ForCounter := 0 TO 63 DO
0022   #Value:=PEEK(area := 16#1,
0023      dbNumber := 0,
0024      byteOffset := #ForCounter);
0025   POKE(area := 16#81,
0026      dbNumber := 0,
0027      byteOffset := #ForCounter,
0028      value := #Value);
0029 END_FOR;
0030 #Value := PEEK(area := 16#1,
0031          dbNumber := 0,
0032          byteOffset := 512);
0033 POKE(area := 16#82,
0034    dbNumber := 0,
0035    byteOffset := 512,
0036    value := #Value);
0037
0038
```

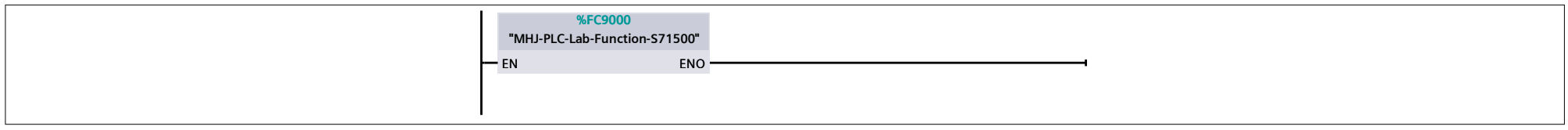
Program blocks

Main [OB1]

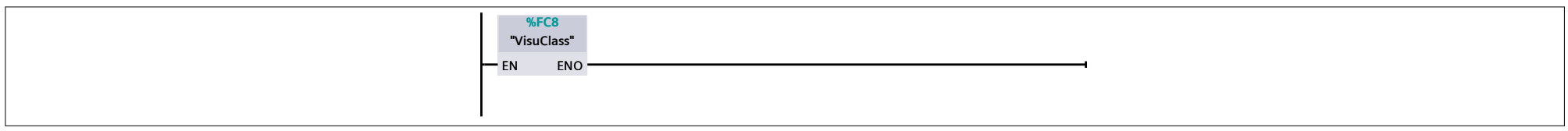
Main Properties							
General							
Name	Main	**Number**	1	**Type**	OB	**Language**	LAD
Numbering	Automatic						
Information							
Title	"Main Program Sweep (Cycle)"	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
Initial_Call	Bool	
Remanence	Bool	
Temp		
Constant		

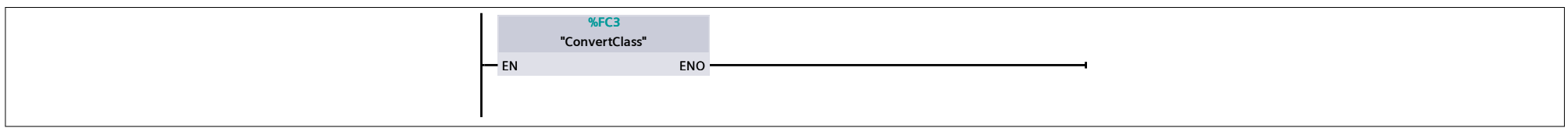
Network 1: Call: MHJ-PLC-Lab-Function-S71500



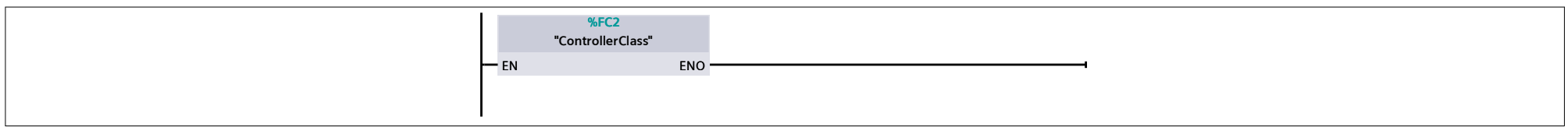
Network 2: Call: VisuClass



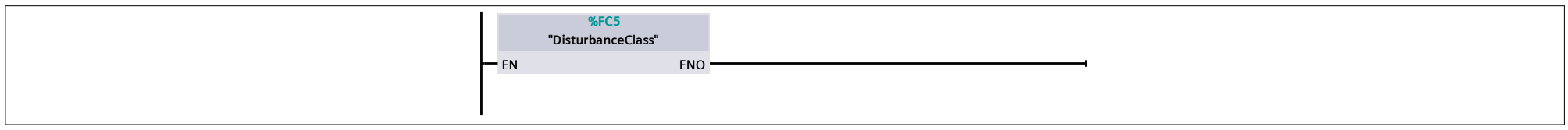
Network 3: Call: ConvertClass



Network 4: Call: ControllerClass



Network 5: Call: DistrubanceClass



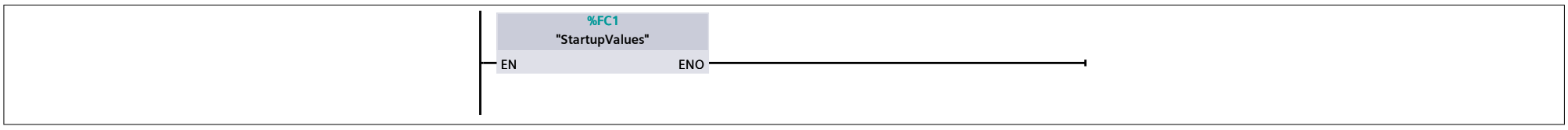
Program blocks

Startup [OB100]

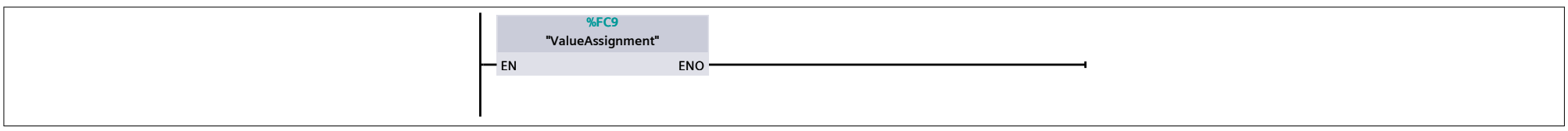
Startup Properties							
General							
Name	Startup	**Number**	100	**Type**	OB	**Language**	LAD
Numbering	Automatic						
Information							
Title	"Complete Restart"	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
LostRetentive	Bool	
LostRTC	Bool	
Temp		
Constant		

Network 1: Call: StartupValues



Network 2: Call: ValueAssigment



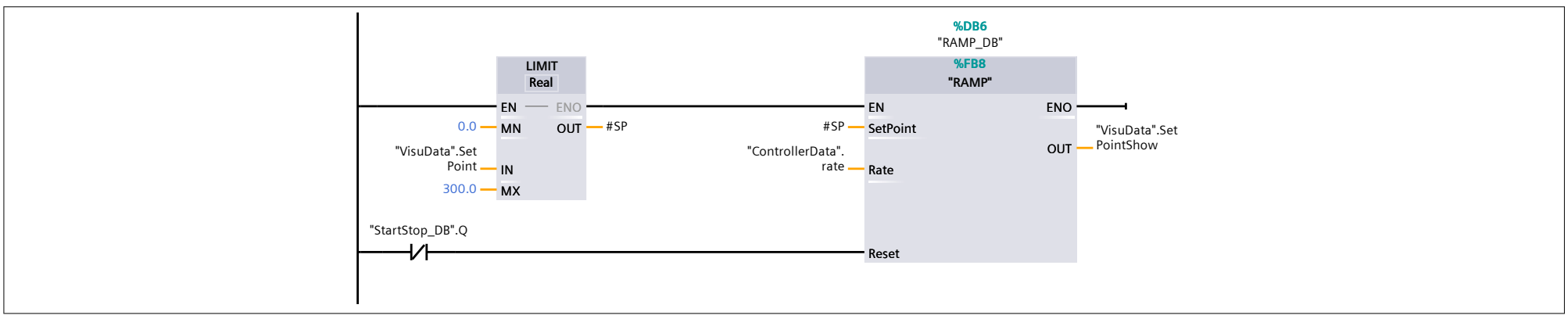
Program blocks / 02_Controller

ControllerClass [FC2]

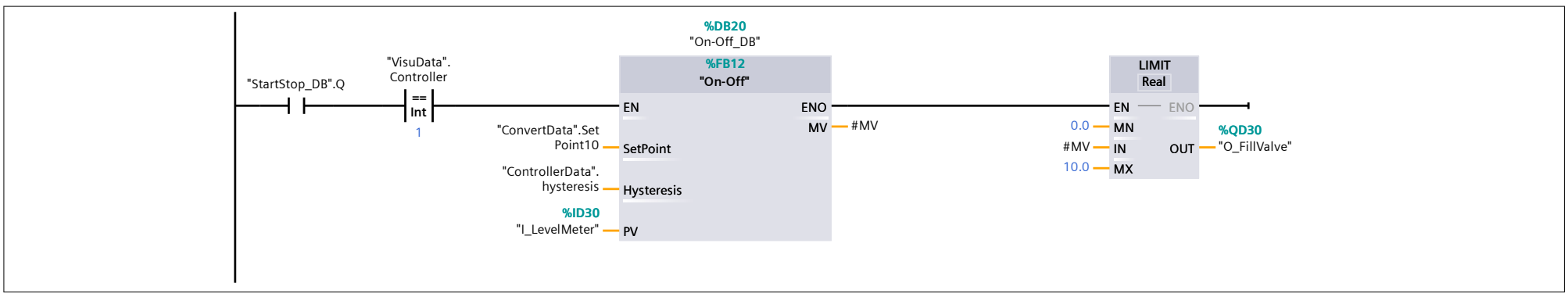
ControllerClass Properties							
General							
Name	ControllerClass	**Number**	2	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title	ControllerClass	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
▼ Temp		
MV	Real	
SP	Real	
Constant		
▼ Return		
ControllerClass	Void	

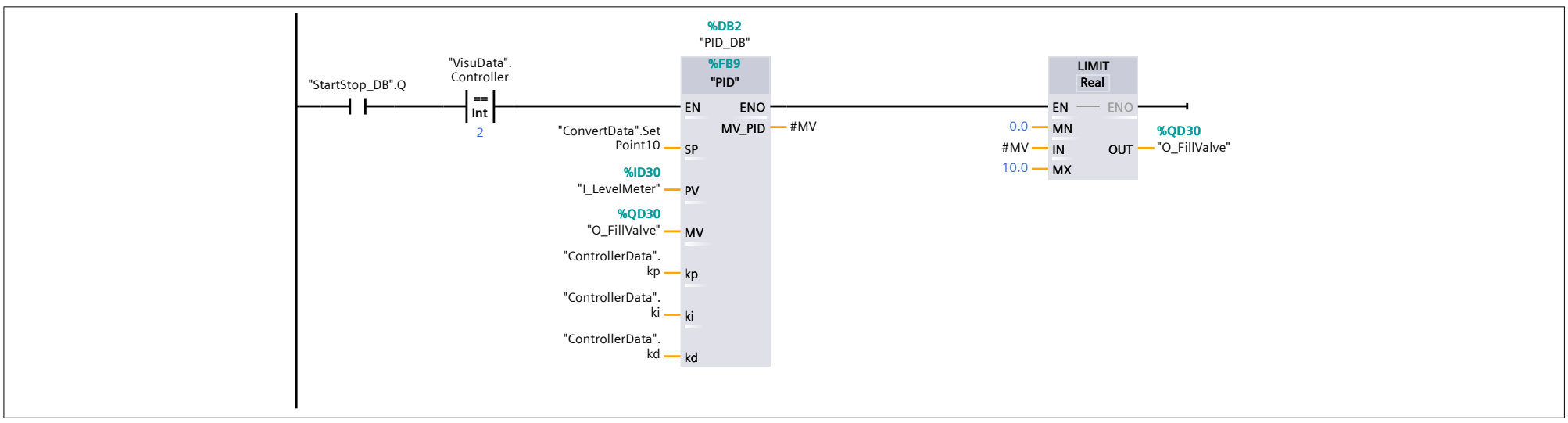
Network 1: Call: Ramp



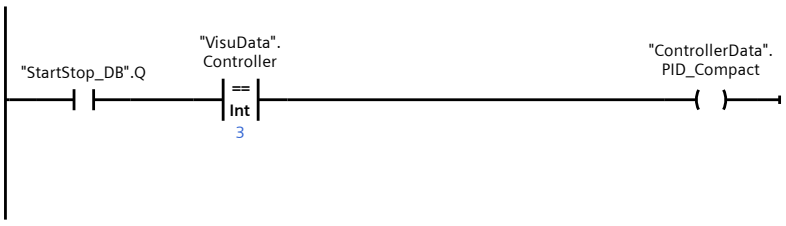
Network 2: Call: On-Off



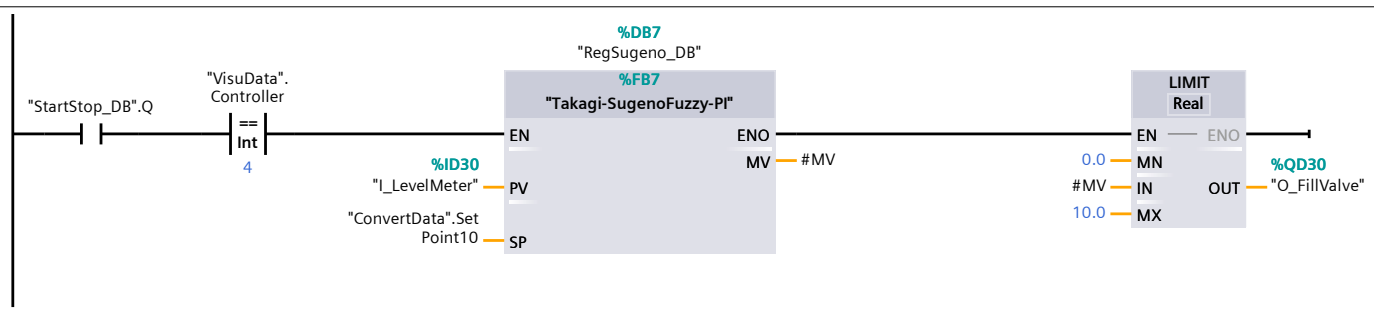
Network 3: Call: PID



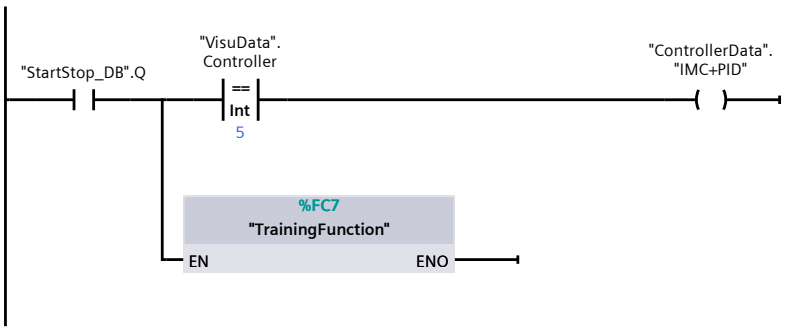
Network 4: Request: PID_C



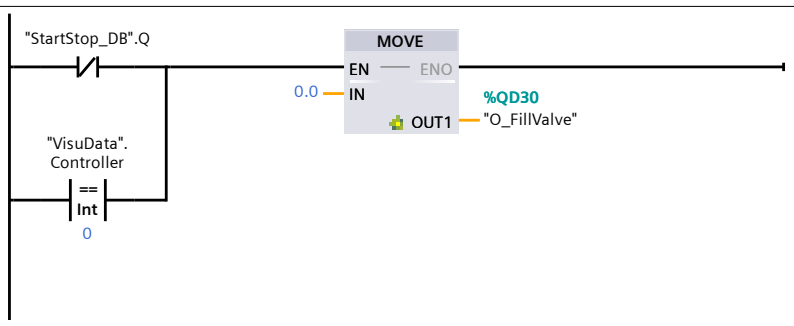
Network 5: Call: Takagi-SugenoFuzzy-PI



Network 6: Call: TrainingFunction && Request: IMC+PID



Network 7: Move: O_FillValve



Program blocks / 02_Controller

Takagi-SugenoFuzzy-PI [FB7]

Takagi-SugenoFuzzy-PI Properties							
General							
Name	Takagi-SugenoFuzzy-PI	**Number**	7	**Type**	FB	**Language**	SCL
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
▼ Input			
PV	Real	0.0	Non-retain
SP	Real	0.0	Non-retain
▼ Output			
MV	Real	0.0	Non-retain
InOut			
▼ Static			
n_e	Real	0.0	Non-retain
i_e	Real	0.0	Non-retain
ni_e	Real	0.0	Non-retain
▼ Temp			
e	Real		
u	Real		
sp_M_e	Real		
sp_S_e	Real		
sp_D_e	Real		
sp_M_ie	Real		
sp_S_ie	Real		
sp_D_ie	Real		
pz1	Real		
pz2	Real		
pz3	Real		
pz4	Real		
pz5	Real		
pz6	Real		
pz7	Real		
pz8	Real		
pz9	Real		
Constant			

```
0001 #n_e:=5.0;
0002 #ni_e:=0.25;
0003
0004 #e:=#SP-#PV;
0005 #e:=#n_e*#e;
0006 IF #e>10.0 THEN
0007   #e := 10.0;
0008 ELSIF #e<-10.0 THEN
0009   #e:=-10.0;
0010 END_IF;
0011
0012 #i_e:=#i_e+#e;
0013 #i_e:=#ni_e*#i_e;
0014 IF #i_e>10.0 THEN
0015   #i_e:=10.0;
0016 ELSIF #i_e<-10.0 THEN
0017   #i_e:=-10.0;
0018 END_IF;
0019
0020 IF #e<0.0 THEN
0021   #sp_M_e:=(#e)/-10.0;
0022   #sp_S_e:=(#e)/10.0+1.0;
0023   #sp_D_e:=0.0;
0024 ELSIF #e>0.0 THEN
0025   #sp_D_e:=(#e)/10.0;
0026   #sp_S_e:=(#e)/-10.0+1.0;
0027   #sp_M_e:=0.0;
0028 ELSE
0029   #sp_M_e:=0.0;
0030   #sp_D_e:=0.0;
0031   #sp_S_e:=1.0;
0032 END_IF;
0033
0034 IF #i_e<0.0 THEN
0035   #sp_M_ie:=(#i_e)/-10.0;
0036   #sp_S_ie:=(#i_e)/10.0+1.0; //jw.
0037   #sp_D_ie:=0.0;
0038 ELSIF #i_e>0.0 THEN
0039   #sp_D_ie:=(#i_e)/10.0;
0040   #sp_S_ie:=(#i_e)/-10.0+1.0;//jw.
```

```
0041    #sp_M_ie:=0.0;
0042  ELSE
0043    #sp_M_ie:=0.0;
0044    #sp_D_ie:=0.0;
0045    #sp_S_ie:=1.0;
0046  END_IF;
0047
0048  #pz1:=MIN(IN1:=#sp_M_e, IN2:=#sp_M_ie);
0049  #pz2:=MIN(IN1:=#sp_S_e, IN2:=#sp_M_ie);
0050  #pz3:=MIN(IN1:=#sp_D_e, IN2:=#sp_M_ie);
0051  #pz4:=MIN(IN1:=#sp_M_e, IN2:=#sp_S_ie);
0052  #pz5:=MIN(IN1:=#sp_S_e, IN2:=#sp_S_ie);
0053  #pz6:=MIN(IN1:=#sp_D_e, IN2:=#sp_S_ie);
0054  #pz7:=MIN(IN1:=#sp_M_e, IN2:=#sp_D_ie);
0055  #pz8:=MIN(IN1:=#sp_S_e, IN2:=#sp_D_ie);
0056  #pz9:=MIN(IN1:=#sp_D_e, IN2:=#sp_D_ie);
0057
0058   #u:=(#pz1*0.0+#pz2*0.0+#pz3*5.0+#pz4*0.0+#pz5*5.0
0059             +#pz6*10.0+#pz7*5.0++#pz8*10.0++#pz9*10.0)
0060             /(#pz1+#pz2+#pz3+#pz4+#pz5+#pz6+#pz7+#pz8+#pz9);
0061
0062  IF #u>10.0 THEN
0063    #u:=10.0;
0064  END_IF;
0065
0066  IF #u < 5.0 AND #u > -5.0 THEN
0067    #u := 0;
0068  END_IF;
0069
0070  IF #u < -10.0 THEN
0071    #u := -10.0;
0072  END_IF;
0073
0074  #MV := #u;
```

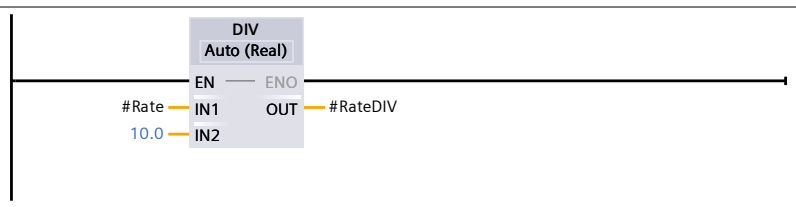
Program blocks / 02_Controller

RAMP [FB8]

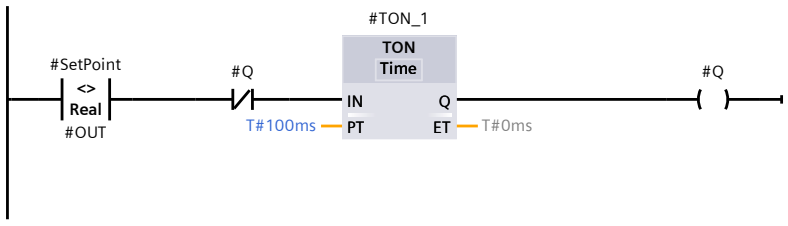
RAMP Properties							
General							
Name	RAMP	**Number**	8	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title	RAMP	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
Input			
SetPoint	Real	0.0	Non-retain
Rate	Real	0.0	Non-retain
Reset	Bool	false	Non-retain
Output			
OUT	Real	0.0	Non-retain
InOut			
Static			
TON_1	TON_TIME		Non-retain
RateDIV	Real	0.0	Non-retain
Q	Bool	false	Non-retain
Temp			
Constant			

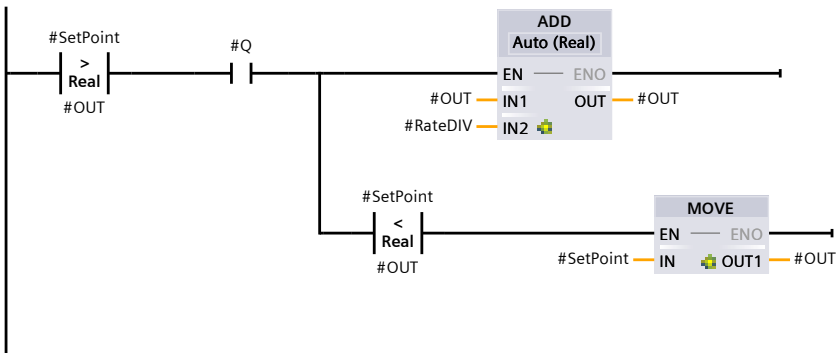
Network 1: DIV: Rate/10



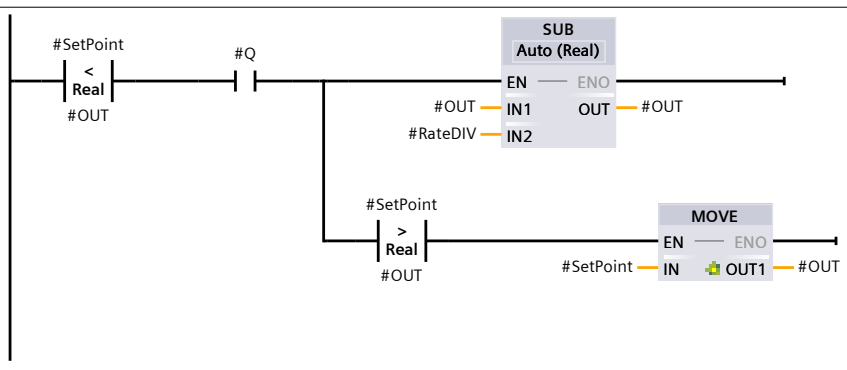
Network 2: TON 100ms



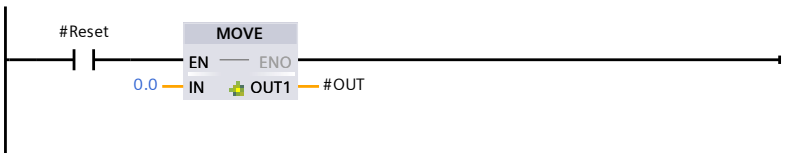
Network 3: SetPoint > OUT ++



Network 4: SetPoint < OUT - -



Network 5: MOVE: Reset -> OUT = 0.0


#Reset
MOVE
EN
ENO
0.0
IN
OUT1
#OUT

Program blocks / 02_Controller

PID [FB9]

PID Properties							
General							
Name	PID	**Number**	9	**Type**	FB	**Language**	SCL
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
SP	Real	0.0
PV	Real	0.0
MV	Real	0.0
kp	Real	0.0
ki	Real	0.0
kd	Real	0.0
▼ Output		
MV_PID	Real	0.0
InOut		
▼ Static		
ep	Array[0..1] of Real	
de	Real	0.0
suma_ep	Real	0.0
Temp		
Constant		

```
0001 #ep[0]:=#SP-#PV;
0002
0003 IF (ABS(#ep[0]))<(ABS(#SP)) THEN
0004   #de:=#ep[0]-#ep[1];
0005
0006   IF #MV<10.0 THEN
0007   IF #MV>-10.0 THEN
0008     #suma_ep:=#suma_ep+#ep[0];
0009   END_IF;
0010   END_IF;
0011
0012   #MV_PID:=#kp*#ep[0] + #ki*#suma_ep + #kd*#de;
0013
0014   IF #MV_PID > 10.0 THEN
0015     #MV_PID := 10.0;
0016   END_IF;
0017
0018   IF #MV_PID < -10.0 THEN
0019     #MV_PID := -10.0;
0020   END_IF;
0021
0022   #ep[1]:=#ep[0];
0023
0024 ELSE
0025   #ep[1]:=0.0;
0026   #suma_ep:=0.0;
0027
0028 END_IF;
```

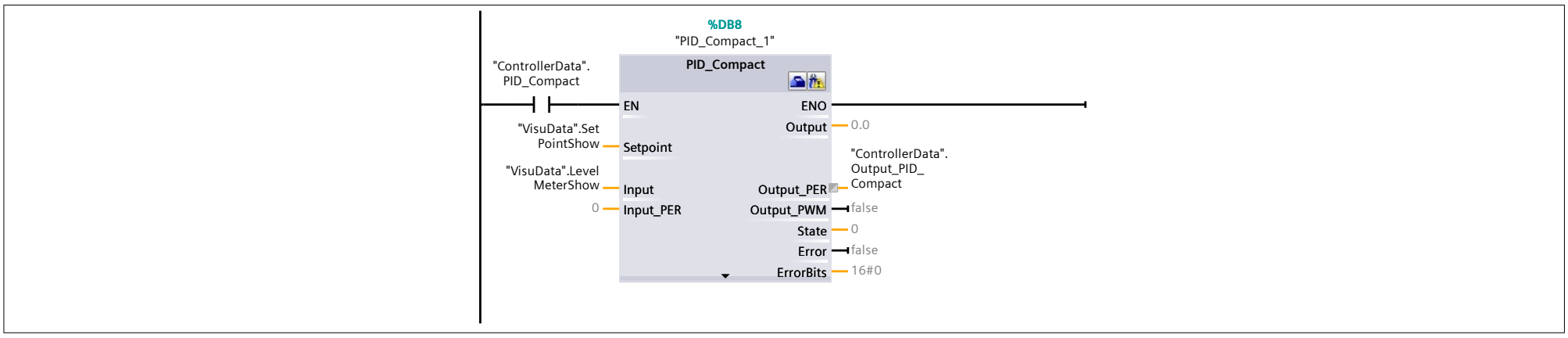
Program blocks / 02_Controller

PID_C [OB30]

PID_C Properties							
General							
Name	PID_C	**Number**	30	**Type**	OB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
Initial_Call	Bool	
Event_Count	Int	
Temp		
Constant		

Network 1: PID_Compact



Program blocks / 02_Controller

ControllerData [DB1]

ControllerData Properties							
General							
Name	ControllerData	**Number**	1	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Static			
PID_Compact	Bool	false	False
Output_PID_Compact	Real	0.0	False
IMC+PID	Bool	false	False
rate	Real	0.0	False
hysteresis	Real	0.0	False
kp	Real	0.0	False
ki	Real	0.0	False
kd	Real	0.0	False

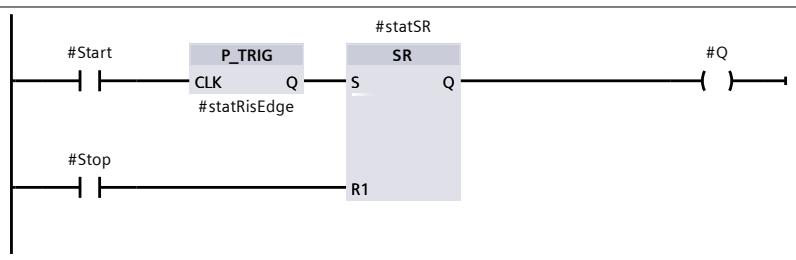
Program blocks / 02_Controller

StartStop [FB11]

StartStop Properties							
General							
Name	StartStop	**Number**	11	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title	StartStop	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
▼ Input			
Start	Bool	false	Non-retain
Stop	Bool	false	Non-retain
▼ Output			
Q	Bool	false	Non-retain
InOut			
▼ Static			
statSR	Bool	false	Non-retain
statRisEdge	Bool	false	Non-retain
Temp			
Constant			

Network 1: P_Trig && SR



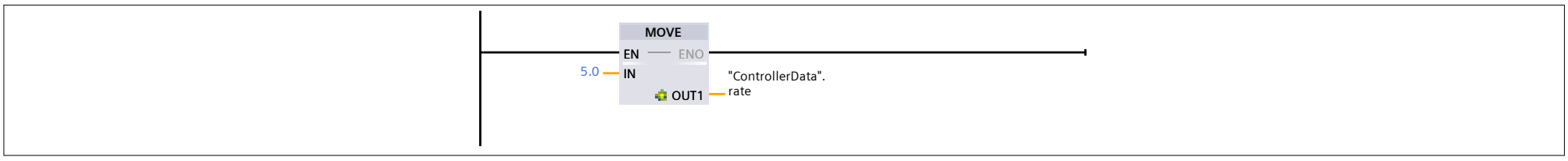
Program blocks / 02_Controller

ValueAssignment [FC9]

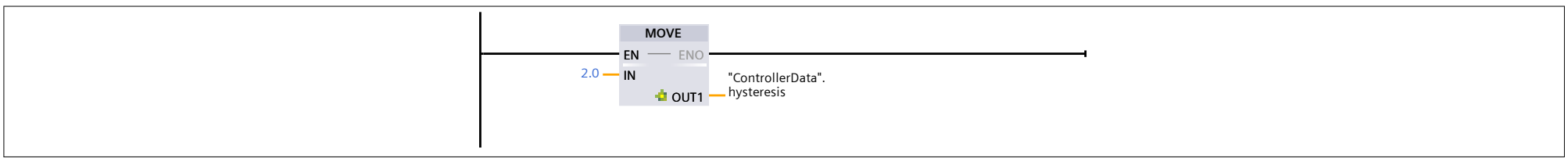
ValueAssignment Properties							
General							
Name	ValueAssignment	**Number**	9	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title	ValueAssignment	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
Temp		
Constant		
▼ Return		
ValueAssignment	Void	

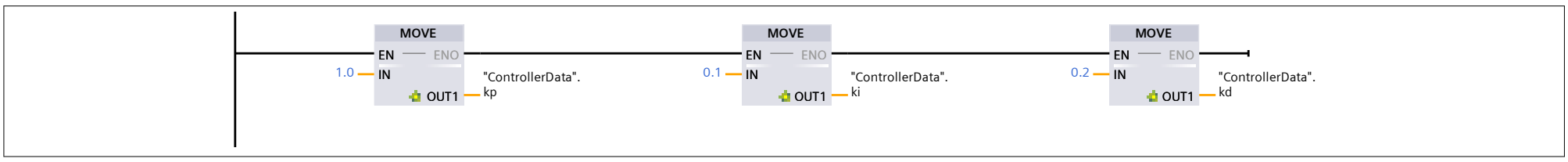
Network 1: Move: rate



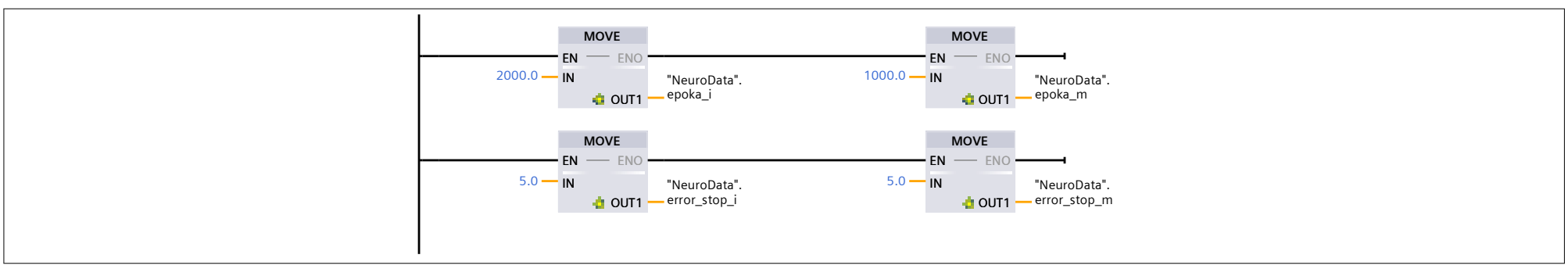
Network 2: Move: hysteresis



Network 3: Move: kp & ki & kd



Network 4: Move: neuralNetwork parameters



Program blocks / 02_Controller

On-Off [FB12]

On-Off Properties							
General							
Name	On-Off	**Number**	12	**Type**	FB	**Language**	SCL
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
▼ Input			
SetPoint	Real	0.0	Non-retain
Hysteresis	Real	0.0	Non-retain
PV	Real	0.0	Non-retain
▼ Output			
MV	Real	0.0	Non-retain
InOut			
▼ Static			
UpperLimit	Real	0.0	Non-retain
LowerLimit	Real	0.0	Non-retain
Temp			
Constant			

```
0001 #UpperLimit := #SetPoint + #Hysteresis / 2;
0002 #LowerLimit := #SetPoint - #Hysteresis / 2;
0003
0004 IF #PV > #UpperLimit THEN
0005   #MV := -10.0;
0006   IF #PV = #LowerLimit THEN
0007     #MV := 0.0;
0008   END_IF;
0009 END_IF;
0010
0011
0012 IF #PV < #LowerLimit THEN
0013   #MV := 10.0;
0014
0015   IF #PV = #UpperLimit THEN
0016     #MV := 0.0;
0017   END_IF;
0018 END_IF;
```

Program blocks / 02_Controller / NeuralNetwork

StartupValues [FC1]

StartupValues Properties							
General							
Name	StartupValues	**Number**	1	**Type**	FC	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
Temp		
Constant		
▼ Return		
StartupValues	Void	

```
0001 "Model_DB".N:=8;
0002 "Inversion_DB".N:=8;
0003
0004 "Model_DB".w1_1[0]:=0.0947;"Model_DB".w1_1[1]:=-0.0755;"Model_DB".w1_1[2]:=-0.0989;"Model_DB".w1_1[3]:=-0.0972;"Mod-
     el_DB".w1_1[4]:=0.0946;"Model_DB".w1_1[5]:=-0.0280;"Model_DB".w1_1[6]:=-0.0111;"Model_DB".w1_1[7]:=-0.0137;
0005 "Model_DB".w1_2[0]:=-0.0590;"Model_DB".w1_2[1]:=-0.0059;"Model_DB".w1_2[2]:=0.0382;"Model_DB".w1_2[3]:=-0.0107;"Mod-
     el_DB".w1_2[4]:=-0.0165;"Model_DB".w1_2[5]:=-0.0539;"Model_DB".w1_2[6]:=0.0721;"Model_DB".w1_2[7]:=0.0880;
0006 "Model_DB".w1_3[0]:=-0.0367;"Model_DB".w1_3[1]:=0.0941;"Model_DB".w1_3[2]:=0.0776;"Model_DB".w1_3[3]:=0.0644;"Mod-
     el_DB".w1_3[4]:=0.0289;"Model_DB".w1_3[5]:=0.0670;"Model_DB".w1_3[6]:=-0.0905;"Model_DB".w1_3[7]:=0.0183;
0007 "Model_DB".w1_4[0]:=0.0985;"Model_DB".w1_4[1]:=-0.0487;"Model_DB".w1_4[2]:=-0.0788;"Model_DB".w1_4[3]:=-0.0514;"Mod-
     el_DB".w1_4[4]:=-0.0354;"Model_DB".w1_4[5]:=0.0116;"Model_DB".w1_4[6]:=-0.0407;"Model_DB".w1_4[7]:=0.0417;
0008 "Model_DB".w1_5[0]:=-0.0128;"Model_DB".w1_5[1]:=0.0692;"Model_DB".w1_5[2]:=-0.0502;"Model_DB".w1_5[3]:=0.0642;"Mod-
     el_DB".w1_5[4]:=0.0651;"Model_DB".w1_5[5]:=-0.0490;"Model_DB".w1_5[6]:=0.0467;"Model_DB".w1_5[7]:=0.0328;
0009 "Model_DB".w1_6[0]:=0.0572;"Model_DB".w1_6[1]:=0.0508;"Model_DB".w1_6[2]:=0.0995;"Model_DB".w1_6[3]:=0.0541;"Mod-
     el_DB".w1_6[4]:=0.0762;"Model_DB".w1_6[5]:=-0.0299;"Model_DB".w1_6[6]:=0.0620;"Model_DB".w1_6[7]:=0.0941;
0010
0011 "Model_DB".w_2[0]:=-0.0526;"Model_DB".w_2[1]:=-0.0155;"Model_DB".w_2[2]:=0.0993;"Model_DB".w_2[3]:=0.0224;"Mod-
     el_DB".w_2[4]:=-0.0963;"Model_DB".w_2[5]:=0.0916;"Model_DB".w_2[6]:=-0.0890;"Model_DB".w_2[7]:=0.0937;
0012
0013 "Model_DB".bias[0]:=-0.0168;"Model_DB".bias[1]:=0.0702;"Model_DB".bias[2]:=0.0775;"Model_DB".bias[3]:=-0.0036;"Mod-
     el_DB".bias[4]:=-0.0820;"Model_DB".bias[5]:=-0.0017;"Model_DB".bias[6]:=0.0254;"Model_DB".bias[7]:=0.0210;
0014 "Model_DB".bias2:=0.0159;
0015
0016 "Inversion_DB".w1_1[0]:=0.0502;"Inversion_DB".w1_1[1]:=-0.0982;"Inversion_DB".w1_1[2]:=-0.0046;"In-
     version_DB".w1_1[3]:=-0.0499;"Inversion_DB".w1_1[4]:=-0.0384;"Inversion_DB".w1_1[5]:=0.0934;"Inver-
     sion_DB".w1_1[6]:=-0.0582;"Inversion_DB".w1_1[7]:=0.0041;
0017 "Inversion_DB".w1_2[0]:=-0.0549;"Inversion_DB".w1_2[1]:=0.0134;"Inversion_DB".w1_2[2]:=0.0996;"In-
     version_DB".w1_2[3]:=-0.0736;"Inversion_DB".w1_2[4]:=0.0909;"Inversion_DB".w1_2[5]:=-0.0752;"Inver-
     sion_DB".w1_2[6]:=-0.0628;"Inversion_DB".w1_2[7]:=0.0293;
0018 "Inversion_DB".w1_3[0]:=-0.0744;"Inversion_DB".w1_3[1]:=-0.0837;"Inversion_DB".w1_3[2]:=0.0318;"In-
     version_DB".w1_3[3]:=-0.0945;"Inversion_DB".w1_3[4]:=0.0970;"Inversion_DB".w1_3[5]:=0.0079;"Inver-
     sion_DB".w1_3[6]:=-0.0252;"Inversion_DB".w1_3[7]:=0.0413;
0019 "Inversion_DB".w1_4[0]:=0.0895;"Inversion_DB".w1_4[1]:=-0.0235;"Inversion_DB".w1_4[2]:=0.0386;"In-
     version_DB".w1_4[3]:=0.0204;"Inversion_DB".w1_4[4]:=0.0551;"Inversion_DB".w1_4[5]:=0.0184;"Inver-
     sion_DB".w1_4[6]:=-0.0248;"Inversion_DB".w1_4[7]:=0.0701;
0020 "Inversion_DB".w1_5[0]:=-0.0549;"Inversion_DB".w1_5[1]:=0.0594;"Inversion_DB".w1_5[2]:=0.0994;"In-
     version_DB".w1_5[3]:=-0.0437;"Inversion_DB".w1_5[4]:=0.0421;"Inversion_DB".w1_5[5]:=0.0329;"Inver-
     sion_DB".w1_5[6]:=-0.0170;"Inversion_DB".w1_5[7]:=-0.0003;
0021 "Inversion_DB".w1_6[0]:=0.0898;"Inversion_DB".w1_6[1]:=0.0906;"Inversion_DB".w1_6[2]:=0.0466;"In-
     version_DB".w1_6[3]:=-0.0231;"Inversion_DB".w1_6[4]:=-0.0920;"Inversion_DB".w1_6[5]:=0.0166;"Inver-
     sion_DB".w1_6[6]:=0.0129;"Inversion_DB".w1_6[7]:=-0.0290;
0022
0023 "Inversion_DB".w_2[0]:=0.0760;"Inversion_DB".w_2[1]:=0.0249;"Inversion_DB".w_2[2]:=0.0248;"In-
     version_DB".w_2[3]:=-0.0409;"Inversion_DB".w_2[4]:=-0.0851;"Inversion_DB".w_2[5]:=-0.0413;"Inver-
     sion_DB".w_2[6]:=-0.0531;"Inversion_DB".w_2[7]:=-0.0308;
0024
0025 "Inversion_DB".bias[0]:=0.0697;"Inversion_DB".bias[1]:=-0.0679;"Inversion_DB".bias[2]:=-0.0684;"In-
     version_DB".bias[3]:=0.0017;"Inversion_DB".bias[4]:=0.0207;"Inversion_DB".bias[5]:=-0.0677;"Inver-
     sion_DB".bias[6]:=0.0271;"Inversion_DB".bias[7]:=0.0688;
0026 "Inversion_DB".bias2:=0.0565;
0027
0028 "Measurement_DB".r_array[0]:=7.7353;"Measurement_DB".r_array[1]:=-1.5888;"Measurement_DB".r_array[2]:=-4.3230;"Measure-
     ment_DB".r_array[3]:=-9.0364;"Measurement_DB".r_array[4]:=-5.6167;
0029 "Measurement_DB".r_array[5]:=-5.2165;"Measurement_DB".r_array[6]:=-9.4148;"Measurement_DB".r_array[7]:=4.0462;"Measure-
     ment_DB".r_array[8]:=-9.8473;"Measurement_DB".r_array[9]:=2.2184;
0030 "Measurement_DB".r_array[10]:=-1.8382;"Measurement_DB".r_array[11]:=-5.0211;"Measurement_DB".r_array[12]:=3.0492;"Meas-
     urement_DB".r_array[13]:=-3.5945;"Measurement_DB".r_array[14]:=-7.9266;
0031 "Measurement_DB".r_array[15]:=0.7113;"Measurement_DB".r_array[16]:=-6.7026;"Measurement_DB".r_array[17]:=7.6688;"Meas-
     urement_DB".r_array[18]:=3.3291;"Measurement_DB".r_array[19]:=6.9548;
0032 "Measurement_DB".r_array[20]:=5.2532;"Measurement_DB".r_array[21]:=6.1403;"Measurement_DB".r_array[22]:=2.6590;"Meas-
     urement_DB".r_array[23]:=4.2085;"Measurement_DB".r_array[24]:=3.7733;
0033 "Measurement_DB".r_array[25]:=-3.5810;"Measurement_DB".r_array[26]:=0.6330;"Measurement_DB".r_array[27]:=7.4639;"Meas-
     urement_DB".r_array[28]:=-8.9092;"Measurement_DB".r_array[29]:=0.0080;
0034 "Measurement_DB".r_array[30]:=-1.3447;"Measurement_DB".r_array[31]:=8.0856;"Measurement_DB".r_array[32]:=2.6037;"Meas-
     urement_DB".r_array[33]:=9.6607;"Measurement_DB".r_array[34]:=1.7040;
```

```
0035 "Measurement_DB".r_array[35]:=6.8127;"Measurement_DB".r_array[36]:=-0.6237;"Measurement_DB".r_array[37]:=0.9044;"Meas-
     urement_DB".r_array[38]:=-6.4179;"Measurement_DB".r_array[39]:=2.6892;
0036 "Measurement_DB".r_array[40]:=9.2592;"Measurement_DB".r_array[41]:=0.6803;"Measurement_DB".r_array[42]:=-0.4077;"Meas-
     urement_DB".r_array[43]:=5.8733;"Measurement_DB".r_array[44]:=-8.1457;
0037 "Measurement_DB".r_array[45]:=7.6160;"Measurement_DB".r_array[46]:=-9.9225;"Measurement_DB".r_array[47]:=0.2306;"Meas-
     urement_DB".r_array[48]:=3.5693;"Measurement_DB".r_array[49]:=1.3150;
0038 "Measurement_DB".r_array[50]:=-0.4308;"Measurement_DB".r_array[51]:=-3.5897;"Measurement_DB".r_array[52]:=2.0316;"Meas-
     urement_DB".r_array[53]:=8.2631;"Measurement_DB".r_array[54]:=3.6504;
0039 "Measurement_DB".r_array[55]:=8.9347;"Measurement_DB".r_array[56]:=-8.0182;"Measurement_DB".r_array[57]:=0.2206;"Meas-
     urement_DB".r_array[58]:=-7.7974;"Measurement_DB".r_array[59]:=0.9052;
0040 "Measurement_DB".r_array[60]:=3.7757;"Measurement_DB".r_array[61]:=-7.0517;"Measurement_DB".r_array[62]:=5.5512;"Meas-
     urement_DB".r_array[63]:=-2.0190;"Measurement_DB".r_array[64]:=7.9660;
0041 "Measurement_DB".r_array[65]:=-3.8591;"Measurement_DB".r_array[66]:=-8.7790;"Measurement_DB".r_ar-
     ray[67]:=-5.6106;"Measurement_DB".r_array[68]:=-8.3433;"Measurement_DB".r_array[69]:=9.0079;
0042 "Measurement_DB".r_array[70]:=-9.6726;"Measurement_DB".r_array[71]:=-7.7066;"Measurement_DB".r_ar-
     ray[72]:=-9.7518;"Measurement_DB".r_array[73]:=-5.6755;"Measurement_DB".r_array[74]:=-9.7714;
0043 "Measurement_DB".r_array[75]:=2.8490;"Measurement_DB".r_array[76]:=0.3398;"Measurement_DB".r_array[77]:=-5.0892;"Meas-
     urement_DB".r_array[78]:=-6.1251;"Measurement_DB".r_array[79]:=-8.1826;
0044 "Measurement_DB".r_array[80]:=-2.6312;"Measurement_DB".r_array[81]:=-9.8441;"Measurement_DB".r_array[82]:=2.0540;"Meas-
     urement_DB".r_array[83]:=-0.4229;"Measurement_DB".r_array[84]:=-3.8376;
0045 "Measurement_DB".r_array[85]:=4.8889;"Measurement_DB".r_array[86]:=6.7870;"Measurement_DB".r_array[87]:=-4.7514;"Meas-
     urement_DB".r_array[88]:=0.2848;"Measurement_DB".r_array[89]:=-1.0645;
0046 "Measurement_DB".r_array[90]:=-3.1758;"Measurement_DB".r_array[91]:=6.7828;"Measurement_DB".r_array[92]:=9.6499;"Meas-
     urement_DB".r_array[93]:=2.5293;"Measurement_DB".r_array[94]:=-6.3745;
0047 "Measurement_DB".r_array[95]:=-7.5397;"Measurement_DB".r_array[96]:=1.5994;"Measurement_DB".r_array[97]:=-3.4293;"Meas-
     urement_DB".r_array[98]:=-4.6363;"Measurement_DB".r_array[99]:=1.0048;
0048 "Measurement_DB".r_array[100]:=-6.3897;"Measurement_DB".r_array[101]:=3.5698;"Measurement_DB".r_ar-
     ray[102]:=-8.8862;"Measurement_DB".r_array[103]:=-9.3189;"Measurement_DB".r_array[104]:=-4.2696;
0049 "Measurement_DB".r_array[105]:=-8.4522;"Measurement_DB".r_array[106]:=8.0114;"Measurement_DB".r_ar-
     ray[107]:=6.9321;"Measurement_DB".r_array[108]:=-2.0860;"Measurement_DB".r_array[109]:=-6.6157;
0050 "Measurement_DB".r_array[110]:=-1.3910;"Measurement_DB".r_array[111]:=-1.6756;"Measurement_DB".r_ar-
     ray[112]:=4.5753;"Measurement_DB".r_array[113]:=-1.8705;"Measurement_DB".r_array[114]:=9.0361;
0051 "Measurement_DB".r_array[115]:=8.2397;"Measurement_DB".r_array[116]:=9.0283;"Measurement_DB".r_ar-
     ray[117]:=-3.0800;"Measurement_DB".r_array[118]:=-4.1951;"Measurement_DB".r_array[119]:=7.7340;
0052 "Measurement_DB".r_array[120]:=-5.7994;"Measurement_DB".r_array[121]:=-7.3825;"Measurement_DB".r_ar-
     ray[122]:=0.4103;"Measurement_DB".r_array[123]:=8.1093;"Measurement_DB".r_array[124]:=-1.9494;
0053 "Measurement_DB".r_array[125]:=-5.6848;"Measurement_DB".r_array[126]:=-8.4252;"Measurement_DB".r_ar-
     ray[127]:=8.6612;"Measurement_DB".r_array[128]:=2.0574;"Measurement_DB".r_array[129]:=-2.4502;
0054 "Measurement_DB".r_array[130]:=3.2986;"Measurement_DB".r_array[131]:=5.8438;"Measurement_DB".r_ar-
     ray[132]:=-3.3302;"Measurement_DB".r_array[133]:=3.8532;"Measurement_DB".r_array[134]:=-5.9237;
0055 "Measurement_DB".r_array[135]:=9.1743;"Measurement_DB".r_array[136]:=4.2366;"Measurement_DB".r_ar-
     ray[137]:=-6.6619;"Measurement_DB".r_array[138]:=-1.1445;"Measurement_DB".r_array[139]:=2.6599;
0056 "Measurement_DB".r_array[140]:=8.5993;"Measurement_DB".r_array[141]:=0.5866;"Measurement_DB".r_ar-
     ray[142]:=2.5295;"Measurement_DB".r_array[143]:=3.6164;"Measurement_DB".r_array[144]:=8.4640;
0057 "Measurement_DB".r_array[145]:=-6.9433;"Measurement_DB".r_array[146]:=-1.8856;"Measurement_DB".r_ar-
     ray[147]:=-3.7505;"Measurement_DB".r_array[148]:=3.8780;"Measurement_DB".r_array[149]:=7.8138;
0058 "Measurement_DB".r_array[150]:=-0.1866;"Measurement_DB".r_array[151]:=6.1165;"Measurement_DB".r_ar-
     ray[152]:=-3.4712;"Measurement_DB".r_array[153]:=0.9976;"Measurement_DB".r_array[154]:=-2.2243;
0059 "Measurement_DB".r_array[155]:=7.9366;"Measurement_DB".r_array[156]:=3.5224;"Measurement_DB".r_ar-
     ray[157]:=6.5679;"Measurement_DB".r_array[158]:=-7.7982;"Measurement_DB".r_array[159]:=-4.4155;
0060 "Measurement_DB".r_array[160]:=5.3527;"Measurement_DB".r_array[161]:=-5.6789;"Measurement_DB".r_ar-
     ray[162]:=-9.3188;"Measurement_DB".r_array[163]:=-1.2690;"Measurement_DB".r_array[164]:=8.7373;
0061 "Measurement_DB".r_array[165]:=-4.7582;"Measurement_DB".r_array[166]:=1.3949;"Measurement_DB".r_ar-
     ray[167]:=-2.8089;"Measurement_DB".r_array[168]:=-9.4632;"Measurement_DB".r_array[169]:=0.0084;
0062 "Measurement_DB".r_array[170]:=6.5403;"Measurement_DB".r_array[171]:=-4.8204;"Measurement_DB".r_ar-
     ray[172]:=-9.0823;"Measurement_DB".r_array[173]:=-5.0706;"Measurement_DB".r_array[174]:=3.2146;
0063 "Measurement_DB".r_array[175]:=-3.4118;"Measurement_DB".r_array[176]:=3.1899;"Measurement_DB".r_ar-
     ray[177]:=-9.7399;"Measurement_DB".r_array[178]:=4.3614;"Measurement_DB".r_array[179]:=-2.1776;
0064 "Measurement_DB".r_array[180]:=-9.3299;"Measurement_DB".r_array[181]:=-1.8797;"Measurement_DB".r_ar-
     ray[182]:=4.3262;"Measurement_DB".r_array[183]:=8.4267;"Measurement_DB".r_array[184]:=9.6803;
0065 "Measurement_DB".r_array[185]:=9.6684;"Measurement_DB".r_array[186]:=7.9261;"Measurement_DB".r_ar-
     ray[187]:=7.3141;"Measurement_DB".r_array[188]:=6.0192;"Measurement_DB".r_array[189]:=1.0996;
0066 "Measurement_DB".r_array[190]:=-1.6226;"Measurement_DB".r_array[191]:=-7.4575;"Measurement_DB".r_ar-
     ray[192]:=3.0924;"Measurement_DB".r_array[193]:=7.2793;"Measurement_DB".r_array[194]:=-4.5080;
0067 "Measurement_DB".r_array[195]:=6.8033;"Measurement_DB".r_array[196]:=-8.5849;"Measurement_DB".r_ar-
     ray[197]:=-2.4242;"Measurement_DB".r_array[198]:=-4.6366;"Measurement_DB".r_array[199]:=-6.9416;
0068 "Measurement_DB".r_array[200]:=2.6200;"Measurement_DB".r_array[201]:=-3.6725;"Measurement_DB".r_ar-
     ray[202]:=9.1822;"Measurement_DB".r_array[203]:=-0.0265;"Measurement_DB".r_array[204]:=4.7722;
0069 "Measurement_DB".r_array[205]:=-9.7449;"Measurement_DB".r_array[206]:=2.1071;"Measurement_DB".r_ar-
     ray[207]:=1.5290;"Measurement_DB".r_array[208]:=6.1476;"Measurement_DB".r_array[209]:=3.0994;
0070 "Measurement_DB".r_array[210]:=7.5646;"Measurement_DB".r_array[211]:=8.0475;"Measurement_DB".r_ar-
     ray[212]:=-6.9553;"Measurement_DB".r_array[213]:=-6.1484;"Measurement_DB".r_array[214]:=5.8195;
0071 "Measurement_DB".r_array[215]:=-8.7859;"Measurement_DB".r_array[216]:=-2.2035;"Measurement_DB".r_ar-
     ray[217]:=-4.0007;"Measurement_DB".r_array[218]:=4.6836;"Measurement_DB".r_array[219]:=-7.9158;
0072 "Measurement_DB".r_array[220]:=5.8515;"Measurement_DB".r_array[221]:=5.6546;"Measurement_DB".r_ar-
     ray[222]:=0.6480;"Measurement_DB".r_array[223]:=-4.9330;"Measurement_DB".r_array[224]:=-8.5809;
0073 "Measurement_DB".r_array[225]:=2.5161;"Measurement_DB".r_array[226]:=-9.5064;"Measurement_DB".r_ar-
     ray[227]:=-8.7592;"Measurement_DB".r_array[228]:=-7.4078;"Measurement_DB".r_array[229]:=-0.9877;
0074 "Measurement_DB".r_array[230]:=3.4467;"Measurement_DB".r_array[231]:=7.1222;"Measurement_DB".r_ar-
     ray[232]:=-0.0311;"Measurement_DB".r_array[233]:=-9.0243;"Measurement_DB".r_array[234]:=-3.7234;
0075 "Measurement_DB".r_array[235]:=2.8326;"Measurement_DB".r_array[236]:=5.7277;"Measurement_DB".r_ar-
     ray[237]:=-4.2170;"Measurement_DB".r_array[238]:=-0.0426;"Measurement_DB".r_array[239]:=6.3687;
0076 "Measurement_DB".r_array[240]:=1.9026;"Measurement_DB".r_array[241]:=0.7285;"Measurement_DB".r_ar-
     ray[242]:=-3.3825;"Measurement_DB".r_array[243]:=-1.7662;"Measurement_DB".r_array[244]:=5.8801;
0077 "Measurement_DB".r_array[245]:=-3.1358;"Measurement_DB".r_array[246]:=-0.7479;"Measurement_DB".r_ar-
     ray[247]:=-2.6435;"Measurement_DB".r_array[248]:=3.5914;"Measurement_DB".r_array[249]:=1.3556;
```

Program blocks / 02_Controller / NeuralNetwork

Measurement [FB1]

Measurement Properties							
General							
Name	Measurement	**Number**	1	**Type**	FB	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
y	Real	0.0
▼ Output		
r	Real	0.0
finish	Bool	false
InOut		
▼ Static		
r_array	Array[0..249] of Real	
y_array	Array[0..249] of Real	
i	Int	0
Temp		
Constant		

```
0001 IF #i=0 THEN
0002   #r:=#r_array[#i];
0003 END_IF;
0004
0005 IF #i>0 THEN
0006   IF #i<250 THEN
0007     #y_array[#i-1]:=#y;
0008     #r:=#r_array[#i];
0009   END_IF;
0010 END_IF;
0011
0012 IF #i=250 THEN
0013   #y_array[#i-1]:=#y;
0014   #finish:=true;
0015   #r:=0.0;
0016 END_IF;
0017
0018 #i:=#i+1;
```

Program blocks / 02_Controller / NeuralNetwork

Object [FB30]

Object Properties							
General							
Name	Object	**Number**	30	**Type**	FB	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
r	Real	0.0
disruption	Real	0.0
▼ Output		
y	Real	0.0
InOut		
▼ Static		
x_array	Array[0..2] of Real	
y_array	Array[0..2] of Real	
Temp		
Constant		

```
0001 #x_array[2]:=#x_array[1];
0002 #x_array[1]:=#x_array[0];
0003 #x_array[0]:=#r;
0004
0005 #y_array[2]:=#y_array[1];
0006 #y_array[1]:=#y_array[0];
0007
0008
0009 #y_array[0]:=0.3*1.3*#x_array[0]+0.1*#x_array[1]+0.6*0.8*#y_array[1]-0.4*1.5*#y_array[2]+0.03*0.5*#y_array[2]*#y_ar-
     ray[2] + #disruption;
0010
0011
0012 IF ABS(#y_array[0])<0.0001 THEN
0013   #y_array[0]:=0.0;
0014 END_IF;
0015
0016 #y:=#y_array[0];
0017
0018
0019
0020
0021
```

Program blocks / 02_Controller / NeuralNetwork

Generator [FB15]

Generator Properties							
General							
Name	Generator	**Number**	15	**Type**	FB	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
▼ Output		
wartosc_zaklocenia	Real	0.0
u	LReal	0.0
InOut		
▼ Static		
k	Real	0.0
i	Int	0
Temp		
Constant		

```
0001 (*SV*)
0002 IF #k<=25.0 THEN
0003 #u:=0.0;
0004 END_IF;
0005 IF #k>25.0 THEN
0006 #u:=2.0;
0007 END_IF;
0008 IF #k>175.0 THEN
0009 #u:=-2.0;
0010 END_IF;
0011 IF #k>250.0 THEN
0012 #u:=2.0*SIN(2.0*3.1416*#k/50.0);
0013 END_IF;
0014 IF #k>400.0 THEN
0015 #u:=0.0;
0016 END_IF;
0017
0018 (*ZAKLOCENIE*)
0019 IF #k<=100.0 THEN
0020 #wartosc_zaklocenia:=0.0;
0021 END_IF;
0022 IF #k>75.0 THEN
0023 #wartosc_zaklocenia:=-1.0;
0024 END_IF;
0025 IF #k>125.0 THEN
0026 #wartosc_zaklocenia:=0.0;
0027 END_IF;
0028 IF #k>300.0 THEN
0029 #wartosc_zaklocenia:=-1.0;
0030 END_IF;
0031 IF #k>400.0 THEN
0032 #wartosc_zaklocenia:=0.0;
0033 END_IF;
0034
0035 #k:=#k+1.0;
```

Program blocks / 02_Controller / NeuralNetwork

IMC+PID [FB5]

IMC+PID Properties							
General							
Name	IMC+PID	**Number**	5	**Type**	FB	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
SP	Real	0.0
PV	Real	0.0
▼ Output		
MV	Real	0.0
InOut		
▼ Static		
PV_model	Real	0.0
e_ob_mo	Real	0.0
e	Real	0.0
ef	Array[0..1] of Real	
MV1	Real	0.0
MV2	Real	0.0
Temp		
Constant		

```
0001 "Model_DB"(wejscie:=#MV,
0002        wyjscie=>#PV_model);
0003
0004
0005 #e_ob_mo:=#PV-#PV_model;
0006 #e:=#SP-#e_ob_mo;
0007
0008 #ef[1]:=#ef[0];
0009 #ef[0]:=0.2835*#e+0.7165*#ef[1];
0010
0011
0012 "Inversion_DB"(wejscie:=#ef[0],
0013         wyjscie=>#MV1);
0014
0015 "PID_DB_1"(SP:=#SP,
0016        PV:=#PV,
0017        MV:=#MV,
0018        kp:=0.2,
0019        ki:=0.8,
0020        kd:=0.1,
0021        MV_PID=>#MV2);
0022
0023
0024 #MV:=#MV1+#MV2;
0025
0026 IF #MV>10.0 THEN
0027   #MV:=10.0;
0028 END_IF;
0029
0030 IF #MV<-10.0 THEN
0031   #MV:=-10.0;
0032 END_IF;
```

Program blocks / 02_Controller / NeuralNetwork

Training [FB2]

Training Properties							
General							
Name	Training	**Number**	2	**Type**	FB	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
error_stop_m	Real	0.0
error_stop_i	Real	0.0
epoch_stop_m	Real	0.0
epoch_stop_i	Real	0.0
training_m	Bool	false
training_i	Bool	false
▼ Output		
error_ep_m	Real	0.0
error_ep_i	Real	0.0
stop_m	Bool	false
stop_i	Bool	false
▼ InOut		
epoch	Real	0.0
▼ Static		
i	Int	0
long	Int	0
s	Array[0..7] of Real	
o	Array[0..7] of Real	
s2	Real	0.0
e2	Real	0.0
e	Array[0..7] of Real	
x_m	Array[0..5] of Real	
x_i	Array[0..5] of Real	
n_m	Real	0.0
n_i	Real	0.0
Temp		
Constant		

```
0001 #n_m:=0.005;
0002 #n_i:=0.001;
0003
0004 IF #training_m=true THEN
0005   FOR #long:=0 TO 249 DO
0006   IF #long=0 THEN
0007     #x_m[2]:=0.0;          // x(k-2)
0008     #x_m[1]:=0.0;          // x(k-1)
0009     #x_m[0]:="Measurement_DB".r_array[#long];  // x(k)
0010     #x_m[5]:=0.0;          // y(k-3)
0011     #x_m[4]:=0.0;          // y(k-2)
0012     #x_m[3]:=0.0;          // y(k-1)
0013   ELSE
0014     #x_m[2]:=#x_m[1];      // x(k-2)
0015     #x_m[1]:=#x_m[0];      // x(k-1)
0016     #x_m[0]:="Measurement_DB".r_array[#long];  // x(k)
0017     #x_m[5]:=#x_m[4];      // y(k-3)
0018     #x_m[4]:=#x_m[3];      // y(k-2)
0019     #x_m[3]:="Measurement_DB".y_array[#long-1]; // y(k-1)
0020   END_IF;
0021
0022   FOR #i:=0 TO "Model_DB".N-1 DO
0023     #s[#i]:=#x_m[0]*"Model_DB".w1_1[#i] + #x_m[1]*"Model_DB".w1_2[#i] + #x_m[2]*"Model_DB".w1_3[#i] + #x_m[3]*"Mod-
el_DB".w1_4[#i];
0024     #s[#i]:=#s[#i] + #x_m[4]*"Model_DB".w1_5[#i] + #x_m[5]*"Model_DB".w1_6[#i] + "Model_DB".bias[#i];
0025     #o[#i]:=(1.0-EXP(-#s[#i]))/(1.0+EXP(-#s[#i]));
0026   END_FOR;
0027
0028   #s2:=0.0;
0029   FOR #i:=0 TO "Model_DB".N-1 DO
0030     #s2:=#s2+#o[#i]*"Model_DB".w_2[#i];
0031   END_FOR;
0032   #s2:=#s2+"Model_DB".bias2;
0033
0034   #e2:="Measurement_DB".y_array[#long]-#s2;
0035
0036   FOR #i:=0 TO "Model_DB".N-1 DO
0037     #e[#i]:=#e2*"Model_DB".w_2[#i]*(1.0-(#o[#i]*#o[#i]));
0038   END_FOR;
0039
0040   FOR #i:=0 TO "Model_DB".N-1 DO
```

```
0041      "Model_DB".w1_1[#i]:="Model_DB".w1_1[#i]+#n_m*#e[#i]*#x_m[0];
0042      "Model_DB".w1_2[#i]:="Model_DB".w1_2[#i]+#n_m*#e[#i]*#x_m[1];
0043      "Model_DB".w1_3[#i]:="Model_DB".w1_3[#i]+#n_m*#e[#i]*#x_m[2];
0044      "Model_DB".w1_4[#i]:="Model_DB".w1_4[#i]+#n_m*#e[#i]*#x_m[3];
0045      "Model_DB".w1_5[#i]:="Model_DB".w1_5[#i]+#n_m*#e[#i]*#x_m[4];
0046      "Model_DB".w1_6[#i]:="Model_DB".w1_6[#i]+#n_m*#e[#i]*#x_m[5];
0047      "Model_DB".bias[#i]:="Model_DB".bias[#i]+#n_m*#e[#i];
0048    END_FOR;
0049
0050    FOR #i:=0 TO "Model_DB".N-1 DO
0051      "Model_DB".w_2[#i]:="Model_DB".w_2[#i]+#n_m*#e2*#o[#i];
0052    END_FOR;
0053      "Model_DB".bias2:="Model_DB".bias2+#n_m*#e2;
0054    END_FOR;
0055
0056    #error_ep_m:=0.0;
0057    #s2:=0.0;
0058    FOR #long:=0 TO 249 DO
0059
0060    IF #long=0 THEN
0061      #x_m[2]:=0.0;          // x(k-2)
0062      #x_m[1]:=0.0;          // x(k-1)
0063      #x_m[0]:="Measurement_DB".r_array[#long];  // x(k)
0064      #x_m[5]:=0.0;          // y(k-3)
0065      #x_m[4]:=0.0;          // y(k-2)
0066      #x_m[3]:=0.0;          // y(k-1)
0067    ELSE
0068      #x_m[2]:=#x_m[1];      // x(k-2)
0069      #x_m[1]:=#x_m[0];      // x(k-1)
0070      #x_m[0]:="Measurement_DB".r_array[#long];  // x(k)
0071      #x_m[5]:=#x_m[4];      // y(k-3)
0072      #x_m[4]:=#x_m[3];      // y(k-2)
0073      #x_m[3]:=#s2;          // y(k-1)
0074    END_IF;
0075
0076    FOR #i:=0 TO "Model_DB".N-1 DO
0077       #s[#i]:=#x_m[0]*"Model_DB".w1_1[#i] + #x_m[1]*"Model_DB".w1_2[#i] + #x_m[2]*"Model_DB".w1_3[#i] + #x_m[3]*"Mod-
      el_DB".w1_4[#i];
0078       #s[#i]:=#s[#i] + #x_m[4]*"Model_DB".w1_5[#i] + #x_m[5]*"Model_DB".w1_6[#i] + "Model_DB".bias[#i];
0079       #o[#i]:=(1.0-EXP(-#s[#i]))/(1.0+EXP(-#s[#i]));
0080    END_FOR;
0081
0082    #s2:=0.0;
0083    FOR #i:=0 TO "Model_DB".N-1 DO
0084      #s2:=#s2+#o[#i]*"Model_DB".w_2[#i];
0085    END_FOR;
0086    #s2:=#s2+"Model_DB".bias2;
0087
0088    #e2:="Measurement_DB".y_array[#long]-#s2;
0089    #error_ep_m:=#error_ep_m+ABS(#e2);
0090    END_FOR;
0091
0092    IF #error_ep_m<#error_stop_m
0093    THEN #stop_m:=true;
0094    ELSE #stop_m:=false;
0095    END_IF;
0096
0097  END_IF;
0098
0099  IF #training_i=true THEN
0100    FOR #long := 0 TO 249 DO
0101    IF #long=0 THEN
0102      #x_i[2]:=0.0;              // y(k-2)
0103      #x_i[1]:=0.0;              // y(k-1)
0104      #x_i[0]:="Measurement_DB".y_array[#long]; // y(k)
0105      #x_i[5]:=0.0;              // x(k-3)
0106      #x_i[4]:=0.0;              // x(k-2)
0107      #x_i[3]:=0.0;              // x(k-1)
0108    ELSE
0109      #x_i[2]:=#x_i[1];          // y(k-2)
0110      #x_i[1]:=#x_i[0];          // y(k-1)
0111      #x_i[0]:="Measurement_DB".y_array[#long]; // y(k)
0112      #x_i[5]:=#x_i[4];          // x(k-3)
0113      #x_i[4]:=#x_i[3];          // x(k-2)
0114      #x_i[3]:="Measurement_DB".r_array[#long-1];  // x(k-1)
0115    END_IF;
0116
0117
0118    FOR #i:=0 TO "Inversion_DB".N-1 DO
0119       #s[#i]:=#x_i[0]*"Inversion_DB".w1_1[#i] + #x_i[1]*"Inversion_DB".w1_2[#i] + #x_i[2]*"Inver-
      sion_DB".w1_3[#i] + #x_i[3]*"Inversion_DB".w1_4[#i];
0120       #s[#i]:=#s[#i] + #x_i[4]*"Inversion_DB".w1_5[#i] + #x_i[5]*"Inversion_DB".w1_6[#i] + "Inversion_DB".bias[#i];
0121       #o[#i]:=(1.0-EXP(-#s[#i]))/(1.0+EXP(-#s[#i]));
0122    END_FOR;
0123
0124    #s2:=0.0;
0125    FOR #i:=0 TO "Inversion_DB".N-1 DO
0126      #s2:=#s2+#o[#i]*"Inversion_DB".w_2[#i];
```

```
0127   END_FOR;
0128   #s2:=#s2+"Inversion_DB".bias2;
0129
0130   #e2:="Measurement_DB".r_array[#long]-#s2;
0131
0132   FOR #i:=0 TO "Inversion_DB".N-1 DO
0133     #e[#i]:=#e2*"Inversion_DB".w_2[#i]*(1.0-#o[#i]*#o[#i]);// gdzie f'(s)=1-o(i)*o(i)
0134   END_FOR;
0135
0136   FOR #i:=0 TO "Inversion_DB".N-1 DO
0137     "Inversion_DB".w1_1[#i]:="Inversion_DB".w1_1[#i]+#n_i*#e[#i]*#x_i[0];
0138     "Inversion_DB".w1_2[#i]:="Inversion_DB".w1_2[#i]+#n_i*#e[#i]*#x_i[1];
0139     "Inversion_DB".w1_3[#i]:="Inversion_DB".w1_3[#i]+#n_i*#e[#i]*#x_i[2];
0140     "Inversion_DB".w1_4[#i]:="Inversion_DB".w1_4[#i]+#n_i*#e[#i]*#x_i[3];
0141     "Inversion_DB".w1_5[#i]:="Inversion_DB".w1_5[#i]+#n_i*#e[#i]*#x_i[4];
0142     "Inversion_DB".w1_6[#i]:="Inversion_DB".w1_6[#i]+#n_i*#e[#i]*#x_i[5];
0143     "Inversion_DB".bias[#i]:="Inversion_DB".bias[#i]+#n_i*#e[#i];
0144   END_FOR;
0145
0146   FOR #i:=0 TO "Inversion_DB".N-1 DO
0147     "Inversion_DB".w_2[#i]:="Inversion_DB".w_2[#i]+#n_i*#e2*#o[#i];
0148   END_FOR;
0149     "Inversion_DB".bias2:="Inversion_DB".bias2+#n_i*#e2;
0150   END_FOR;
0151
0152   #error_ep_i:=0.0;
0153   #s2:=0.0;
0154   FOR #long := 0 TO 249 DO
0155
0156   IF #long=0 THEN
0157     #x_i[2]:=0.0;              // y(k-2)
0158     #x_i[1]:=0.0;              // y(k-1)
0159     #x_i[0]:="Measurement_DB".y_array[#long]; // y(k)
0160     #x_i[5]:=0.0;              // x(k-3)
0161     #x_i[4]:=0.0;              // x(k-2)
0162     #x_i[3]:=0.0;              // x(k-1)
0163   ELSE
0164     #x_i[2]:=#x_i[1];          // y(k-2)
0165     #x_i[1]:=#x_i[0];          // y(k-1)
0166     #x_i[0]:="Measurement_DB".y_array[#long]; // y(k)
0167     #x_i[5]:=#x_i[4];          // x(k-3)
0168     #x_i[4]:=#x_i[3];          // x(k-2)
0169     #x_i[3]:=#s2;              // x(k-1)
0170   END_IF;
0171
0172   FOR #i:=0 TO "Inversion_DB".N-1 DO
0173      #s[#i]:=#x_i[0]*"Inversion_DB".w1_1[#i] + #x_i[1]*"Inversion_DB".w1_2[#i] + #x_i[2]*"Inver-
     sion_DB".w1_3[#i] + #x_i[3]*"Inversion_DB".w1_4[#i] + #x_i[4]*"Inversion_DB".w1_5[#i] + #x_i[5]*"Inver-
     sion_DB".w1_6[#i] + "Inversion_DB".bias[#i];
0174      #o[#i]:=(1.0-EXP(-#s[#i]))/(1.0+EXP(-#s[#i]));
0175   END_FOR;
0176
0177   #s2:=0.0;
0178   FOR #i:=0 TO "Inversion_DB".N-1 DO
0179     #s2:=#s2+#o[#i]*"Inversion_DB".w_2[#i];
0180   END_FOR;
0181   #s2:=#s2+"Inversion_DB".bias2;
0182
0183   #e2:="Measurement_DB".r_array[#long]-#s2;
0184   #error_ep_i:=#error_ep_i+ABS(#e2);
0185   END_FOR;
0186
0187   IF #error_ep_i<#error_stop_i
0188   THEN #stop_i:=true;
0189   ELSE #stop_i:=false;
0190   END_IF;
0191
0192 END_IF;
0193
0194
0195 IF #epoch=(#epoch_stop_m-1)
0196 THEN #stop_m:=true;
0197 END_IF;
0198 IF #epoch=(#epoch_stop_i-1)
0199 THEN #stop_i:=true;
0200 END_IF;
0201 #epoch:=#epoch+1.0;
```

Program blocks / 02_Controller / NeuralNetwork

Model [FB3]

Model Properties							
General							
Name	Model	**Number**	3	**Type**	FB	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
wejscie	Real	0.0
▼ Output		
wyjscie	Real	0.0
InOut		
▼ Static		
x	Array[0..5] of Real	
s	Array[0..7] of Real	
o	Array[0..7] of Real	
s2	Real	0.0
i	Int	0
w1_1	Array[0..7] of Real	
w1_2	Array[0..7] of Real	
w1_3	Array[0..7] of Real	
w1_4	Array[0..7] of Real	
w1_5	Array[0..7] of Real	
w1_6	Array[0..7] of Real	
w_2	Array[0..7] of Real	
bias	Array[0..7] of Real	
bias2	Real	0.0
N	Int	0
Temp		
Constant		

```
0001 #x[2]:=#x[1];              // x(k-2)
0002 #x[1]:=#x[0];              // x(k-1)
0003 #x[0]:=#wejscie;           // x(k)
0004 #x[5]:=#x[4];              // y(k-3)
0005 #x[4]:=#x[3];              // y(k-2)
0006 #x[3]:=#s2;                // y(k-1)
0007
0008 FOR #i:=0 TO #N-1 DO
0009    #s[#i]:=#x[0]*#w1_1[#i] + #x[1]*#w1_2[#i] + #x[2]*#w1_3[#i];
0010    #s[#i]:=#s[#i] + #x[3]*#w1_4[#i] + #x[4]*#w1_5[#i] + #x[5]*#w1_6[#i] + #bias[#i]; // jw, + bias
0011    #o[#i]:=(1.0-EXP(-#s[#i]))/(1.0+EXP(-#s[#i])); //f. activation sigmoidalna
0012  END_FOR;
0013
0014 #s2:=0.0;
0015 FOR #i:=0 TO #N-1 DO
0016   #s2:=#s2+#o[#i]*#w_2[#i];
0017 END_FOR;
0018
0019 #s2:=#s2+#bias2;
0020 #wyjscie:=#s2;
```

Program blocks / 02_Controller / NeuralNetwork

Inversion [FB4]

Inversion Properties							
General							
Name	Inversion	**Number**	4	**Type**	FB	**Language**	SCL
Numbering	Manual						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
wejscie	Real	0.0
▼ Output		
wyjscie	Real	0.0
InOut		
▼ Static		
x	Array[0..5] of Real	
s	Array[0..7] of Real	
o	Array[0..7] of Real	
s2	Real	0.0
i	Int	0
w1_1	Array[0..7] of Real	
w1_2	Array[0..7] of Real	
w1_3	Array[0..7] of Real	
w1_4	Array[0..7] of Real	
w1_5	Array[0..7] of Real	
w1_6	Array[0..7] of Real	
w_2	Array[0..7] of Real	
bias	Array[0..7] of Real	
bias2	Real	0.0
N	Int	0
Temp		
Constant		

```
0001 #x[2]:=#x[1];              // x(k-2)
0002 #x[1]:=#x[0];              // x(k-1)
0003 #x[0]:=#wejscie;           // x(k)
0004 #x[5]:=#x[4];              // y(k-3)
0005 #x[4]:=#x[3];              // y(k-2)
0006 #x[3]:=#s2;                // y(k-1)
0007
0008 FOR #i:=0 TO #N-1 DO
0009    #s[#i]:=#x[0]*#w1_1[#i] + #x[1]*#w1_2[#i] + #x[2]*#w1_3[#i];
0010    #s[#i]:=#s[#i] + #x[3]*#w1_4[#i] + #x[4]*#w1_5[#i] + #x[5]*#w1_6[#i] + #bias[#i]; // jw, + bias
0011    #o[#i]:=(1.0-EXP(-#s[#i]))/(1.0+EXP(-#s[#i])); // f. sigmoidalna
0012  END_FOR;
0013
0014 #s2:=0.0;
0015 FOR #i:=0 TO #N-1 DO
0016   #s2:=#s2+#o[#i]*#w_2[#i];
0017 END_FOR;
0018
0019 #s2:=#s2+#bias2;
0020 #wyjscie:=#s2;
```

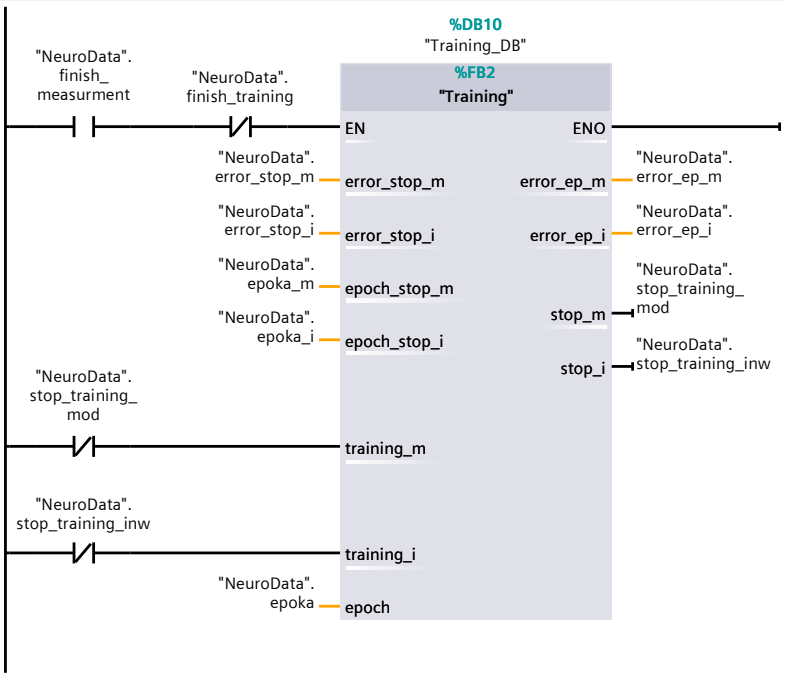
Program blocks / 02_Controller / NeuralNetwork

TrainingFunction [FC7]

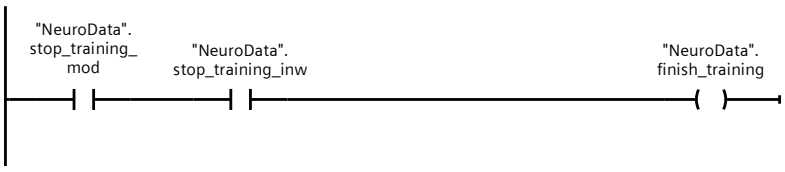
TrainingFunction Properties							
General							
Name	TrainingFunction	**Number**	7	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title	TrainingFunction	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
Temp		
Constant		
▼ Return		
TrainingFunction	Void	

Network 1: Call: Training



Network 2: Show finish_training



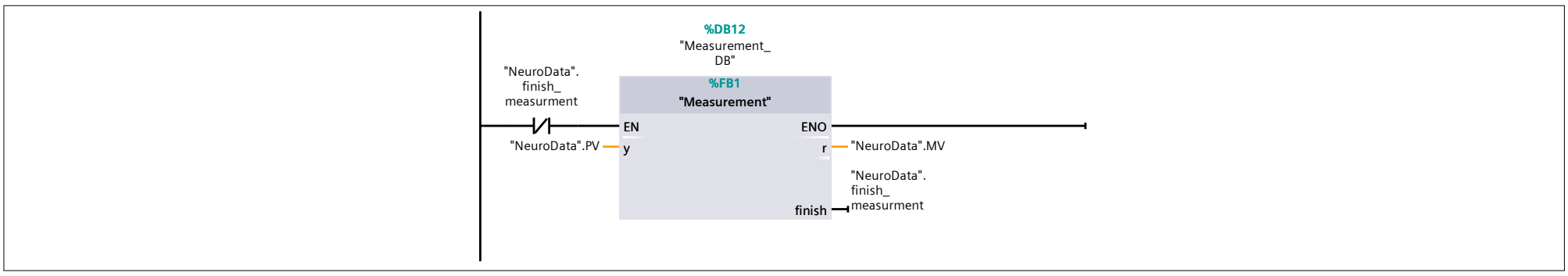
Program blocks / 02_Controller / NeuralNetwork

NeuralNetwork [OB31]

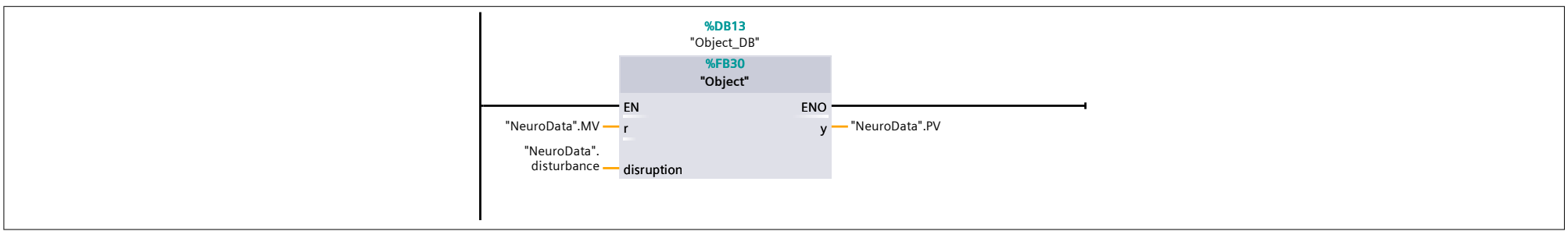
NeuralNetwork Properties							
General							
Name	NeuralNetwork	**Number**	31	**Type**	OB	**Language**	LAD
Numbering	Automatic						
Information							
Title	NeuralNetwork	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Initial_Call	Bool	
Event_Count	Int	
Temp		
MV	Real	
Constant		

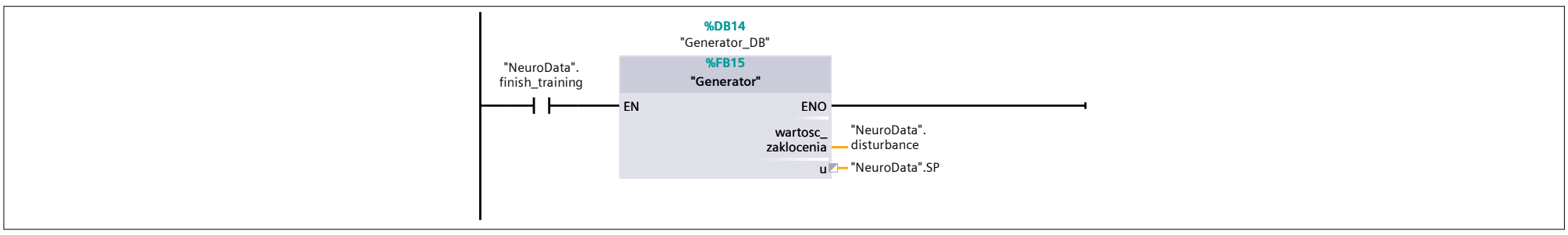
Network 1: Call: Measurement



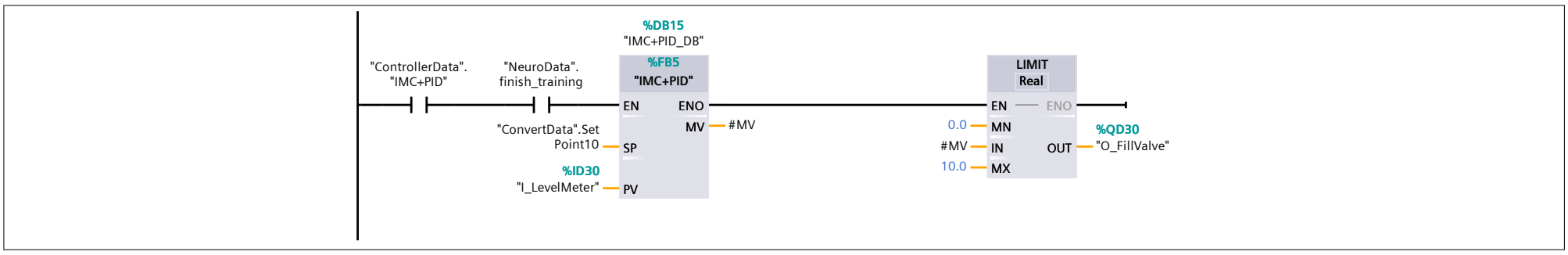
Network 2: Call: Object



Network 3: Call: Generator



Network 4: Call: IMC+PID



Program blocks / 02_Controller / NeuralNetwork

NeuroData [DB18]

NeuroData Properties							
General							
Name	NeuroData	**Number**	18	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Static			
finish_measurment	Bool	false	False
disturbance	Real	0.0	False
PV	Real	0.0	False
MV	Real	0.0	False
SP	Real	0.0	False
stop_training_inw	Bool	false	False
stop_training_mod	Bool	false	False
epoka	Real	0.0	False
error_ep_m	Real	0.0	False
error_ep_i	Real	0.0	False
error_stop_m	Real	0.0	False
error_stop_i	Real	0.0	False
epoka_m	Real	0.0	False
epoka_i	Real	0.0	False
move	Bool	false	False
p_move	Bool	false	False
finish_training	Bool	false	False

Program blocks / 01_Convert

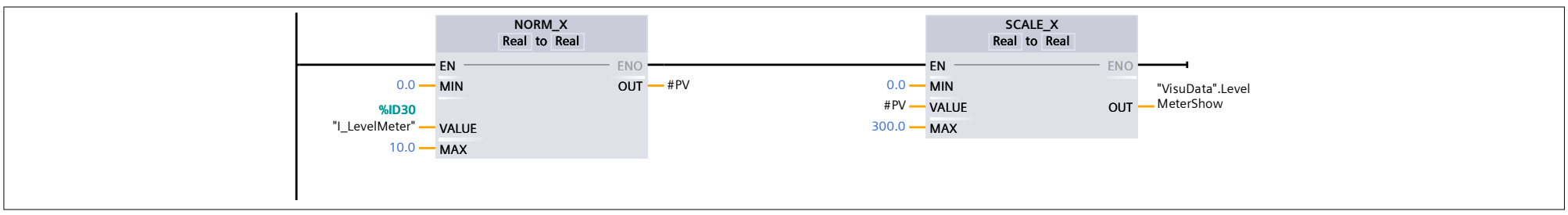
ConvertClass [FC3]

ConvertClass Properties							
General							
Name	ConvertClass	**Number**	3	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title	ConvertClass	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

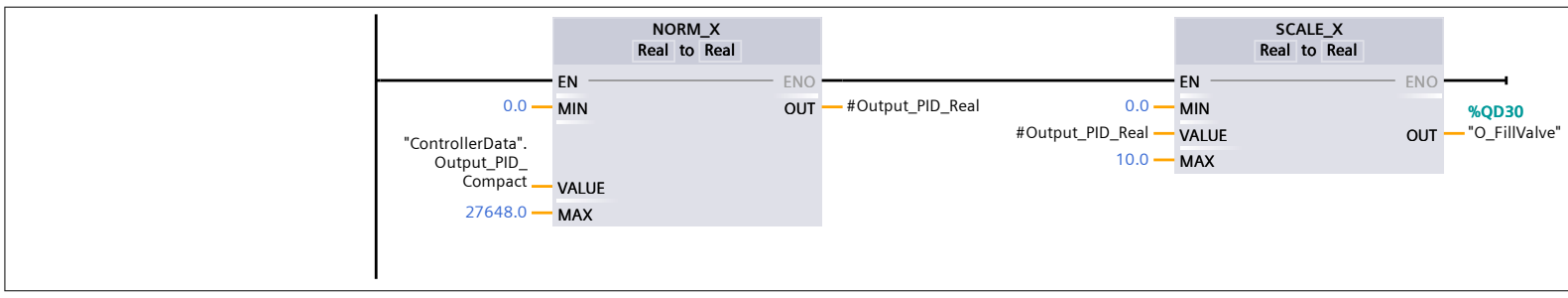
Name	Data type	Default value
Input		
Output		
InOut		
▼ Temp		
Output_PID_Real	Real	
PV	Real	
SP	Real	
SPRamp	Real	
Constant		
▼ Return		
ConvertClass	Void	

Network 1: Convert SetPoint: 0-300 -> 0-10

Network 2: Convert LevelMeter: 0-10 -> 0-300



Network 3: Convert Output_PID_Compact: 0-27648 -> 0-10



Program blocks / 01_Convert

ConvertData [DB4]

ConvertData Properties							
General							
Name	ConvertData	**Number**	4	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Static			
SetPoint10	Real	0.0	False

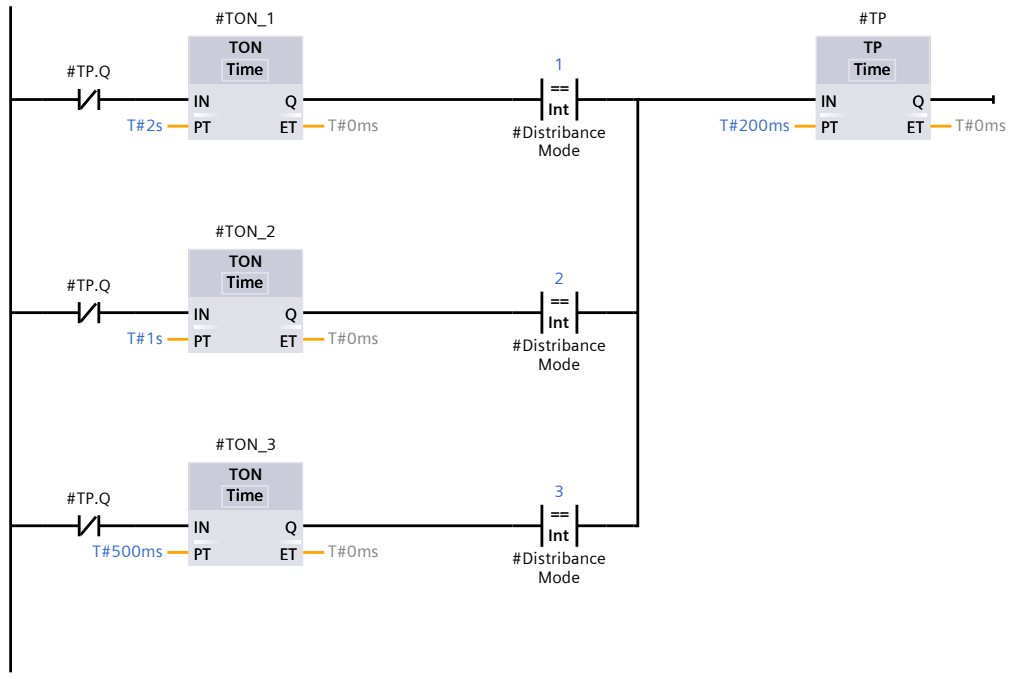
Program blocks / 03_Disturbance

RandomDisturbance [FB10]

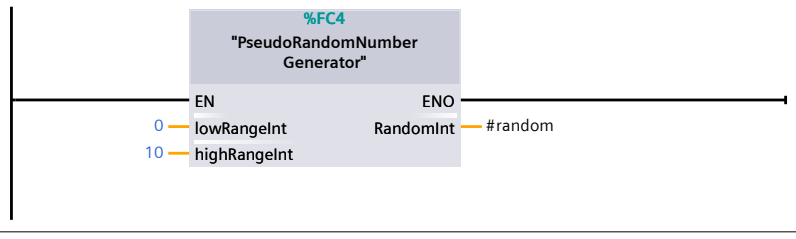
RandomDisturbance Properties							
General							
Name	RandomDisturbance	**Number**	10	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title	RandomDisturbance	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
Input			
DistribanceMode	Int	0	Non-retain
Outflow	Int	0	Non-retain
Output			
DischargeValve	Int	0	Non-retain
InOut			
Static			
TON_1	TON_TIME		Non-retain
TON_2	TON_TIME		Non-retain
TP	TP_TIME		Non-retain
TON_3	TON_TIME		Non-retain
random	Int	0	Non-retain
p_Q	Bool	false	Non-retain
Temp			
Constant			

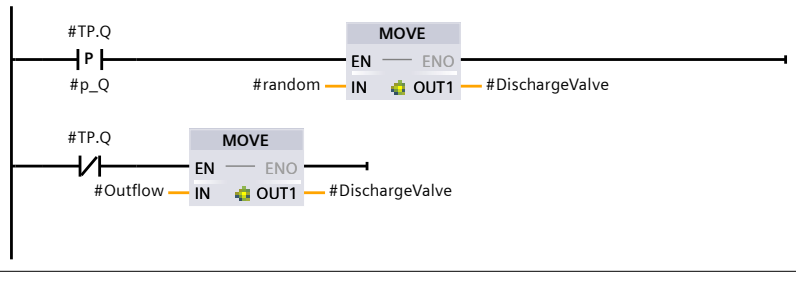
Network 1: Disturbance



Network 2: Call: PseudoRandomNumerGenerator



Network 3: Move: Discharge



Program blocks / 03_Disturbance

PseudoRandomNumberGenerator [FC4]

PseudoRandomNumberGenerator Properties							
General							
Name	PseudoRandomNumberGen-erator	**Number**	4	**Type**	FC	**Language**	SCL
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
lowRangeInt	Int	
highRangeInt	Int	
▼ Output		
RandomInt	Int	
InOut		
▼ Temp		
diTime	DInt	
rTime	Real	
timeTck	Time	
rTemp	Real	
Constant		
▼ Return		
PseudoRandomNumberGenerator	Void	

```
0001   // read systemtime
0002  #timeTck := TIME_TCK(); // TIME
0003
0004  // calculate random number
0005  #diTime := TIME_TO_DINT(#timeTck);
0006  #rTime := DINT_TO_REAL(#diTime);
0007  #rTemp := SIN(#rTime);
0008
0009  IF #rTemp < 0 THEN
0010    #rTemp := #rTemp * (-1);
0011  END_IF;
0012
0013  #RandomInt := REAL_TO_INT(#rTemp*(#highRangeInt-#lowRangeInt))+#lowRangeInt;
```

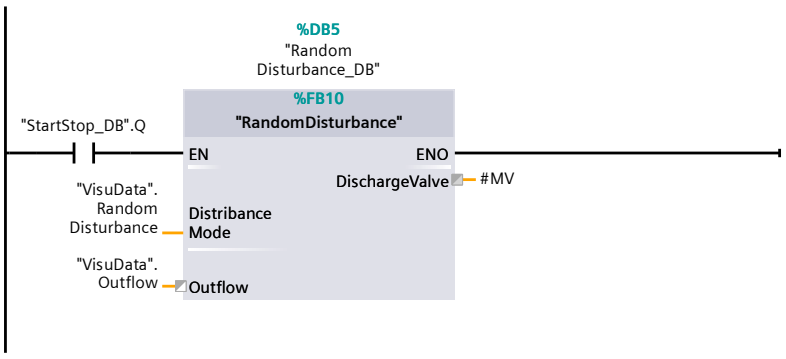
Program blocks / 03_Disturbance

DisturbanceClass [FC5]

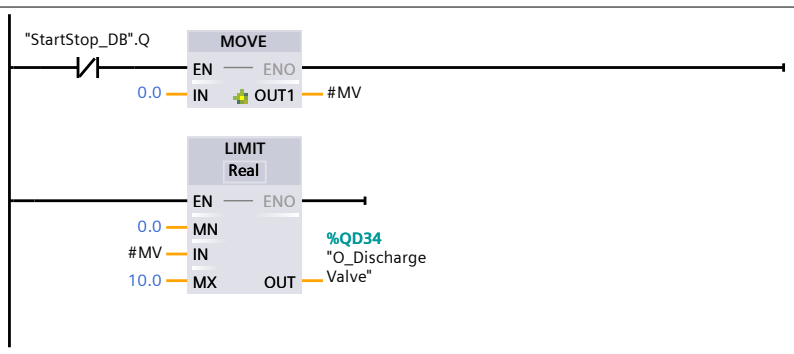
DisturbanceClass Properties							
General							
Name	DisturbanceClass	**Number**	5	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title	DisturbanceClass	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
▼ Temp		
MV	Real	
Constant		
▼ Return		
DisturbanceClass	Void	

Network 1: Call: RandomDisturbance



Network 2: Move: O_DischargeValve



Program blocks / System blocks / Program resources

PID_Compact [FB1130]

PID_Compact Properties							
General							
Name	PID_Compact	**Number**	1130	**Type**	FB	**Language**	SCL
Numbering	Automatic						
Information							
Title	Compact PID_Controller with self-tuning	**Author**	SIMATIC	**Comment**		**Family**	COMPPID
Version	2.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Default value	Retain
▼ Input			
Setpoint	Real	0.0	Non-retain
Input	Real	0.0	Non-retain
Input_PER	Int	0	Non-retain
Disturbance	Real	0.0	Non-retain
ManualEnable	Bool	false	Non-retain
ManualValue	Real	0.0	Non-retain
ErrorAck	Bool	false	Non-retain
Reset	Bool	false	Non-retain
ModeActivate	Bool	false	Non-retain
▼ Output			
ScaledInput	Real	0.0	Non-retain
Output	Real	0.0	Non-retain
Output_PER	Int	0	Non-retain
Output_PWM	Bool	false	Non-retain
SetpointLimit_H	Bool	false	Non-retain
SetpointLimit_L	Bool	false	Non-retain
InputWarning_H	Bool	false	Non-retain
InputWarning_L	Bool	false	Non-retain
State	Int	0	Non-retain
Error	Bool	false	Non-retain
ErrorBits	DWord	16#0	Retain
▼ InOut			
Mode	Int	4	Retain
▼ Static			
InternalDiagnostic	DWord	0	Non-retain
InternalVersion	DWord	DW#16#02020001	Non-retain
InternalRTVersion	DWord	0	Non-retain
IntegralResetMode	Int	1	Non-retain
OverwriteInitialOutputValue	Real	0.0	Non-retain
RunModeByStartup	Bool	true	Non-retain
LoadBackUp	Bool	false	Non-retain
SetSubstituteOutput	Bool	true	Non-retain
PhysicalUnit	Int	0	Non-retain
PhysicalQuantity	Int	0	Non-retain
ActivateRecoverMode	Bool	true	Non-retain
Warning	DWord	16#0	Retain
WarningInternal	DWord	16#0	Retain
Progress	Real	0.0	Non-retain
CurrentSetpoint	Real	0.0	Non-retain
CancelTuningLevel	Real	10.0	Non-retain
SubstituteOutput	Real	0.0	Non-retain
Config	PID_CompactConfig		Non-retain
CycleTime	PID_CycleTime		Non-retain
CtrlParamsBackUp	PID_CompactControlParams		Non-retain
PIDSelfTune	PID_CompactSelfTune		Non-retain
PIDCtrl	PID_CompactControl		Non-retain
Retain	PID_CompactRetain		Retain

Program blocks / System blocks / Program resources

PID_DB [DB2]

PID_DB Properties							
General							
Name	PID_DB	**Number**	2	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
SP	Real	0.0	False
PV	Real	0.0	False
MV	Real	0.0	False
kp	Real	0.0	False
ki	Real	0.0	False
kd	Real	0.0	False
▼ Output			
MV_PID	Real	0.0	False
InOut			
▼ Static			
ep	Array[0..1] of Real		False
de	Real	0.0	False
suma_ep	Real	0.0	False

Program blocks / System blocks / Program resources

RAMP_DB [DB6]

RAMP_DB Properties							
General							
Name	RAMP_DB	**Number**	6	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
SetPoint	Real	0.0	False
Rate	Real	0.0	False
Reset	Bool	false	False
▼ Output			
OUT	Real	0.0	False
InOut			
▼ Static			
TON_1	TON_TIME		False
RateDIV	Real	0.0	False
Q	Bool	false	False

Program blocks / System blocks / Program resources

RegSugeno_DB [DB7]

RegSugeno_DB Properties							
General							
Name	RegSugeno_DB	**Number**	7	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
PV	Real	0.0	False
SP	Real	0.0	False
▼ Output			
MV	Real	0.0	False
InOut			
▼ Static			
n_e	Real	0.0	False
i_e	Real	0.0	False
ni_e	Real	0.0	False

Program blocks / System blocks / Program resources

RandomDisturbance_DB [DB5]

RandomDisturbance_DB Properties							
General							
Name	RandomDisturbance_DB	**Number**	5	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
DistribanceMode	Int	0	False
Outflow	Int	0	False
▼ Output			
DischargeValve	Int	0	False
InOut			
▼ Static			
TON_1	TON_TIME		False
TON_2	TON_TIME		False
TP	TP_TIME		False
TON_3	TON_TIME		False
random	Int	0	False
p_Q	Bool	false	False

Program blocks / System blocks / Program resources

StartStop_DB [DB19]

StartStop_DB Properties							
General							
Name	StartStop_DB	**Number**	19	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
Start	Bool	false	False
Stop	Bool	false	False
▼ Output			
Q	Bool	false	False
InOut			
▼ Static			
statSR	Bool	false	False
statRisEdge	Bool	false	False

Program blocks / System blocks / Program resources

Generator_DB [DB14]

Generator_DB Properties							
General							
Name	Generator_DB	**Number**	14	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
Input			
▼ Output			
wartosc_zaklocenia	Real	0.0	False
u	LReal	0.0	False
InOut			
▼ Static			
k	Real	0.0	False
i	Int	0	False

Program blocks / System blocks / Program resources

IMC+PID_DB [DB15]

IMC+PID_DB Properties							
General							
Name	IMC+PID_DB	**Number**	15	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
SP	Real	0.0	False
PV	Real	0.0	False
▼ Output			
MV	Real	0.0	False
InOut			
▼ Static			
PV_model	Real	0.0	False
e_ob_mo	Real	0.0	False
e	Real	0.0	False
ef	Array[0..1] of Real		False
MV1	Real	0.0	False
MV2	Real	0.0	False

Program blocks / System blocks / Program resources

Inversion_DB [DB17]

Inversion_DB Properties							
General							
Name	Inversion_DB	**Number**	17	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
wejscie	Real	0.0	False
▼ Output			
wyjscie	Real	0.0	False
InOut			
▼ Static			
x	Array[0..5] of Real		False
s	Array[0..7] of Real		False
o	Array[0..7] of Real		False
s2	Real	0.0	False
i	Int	0	False
w1_1	Array[0..7] of Real		False
w1_2	Array[0..7] of Real		False
w1_3	Array[0..7] of Real		False
w1_4	Array[0..7] of Real		False
w1_5	Array[0..7] of Real		False
w1_6	Array[0..7] of Real		False
w_2	Array[0..7] of Real		False
bias	Array[0..7] of Real		False
bias2	Real	0.0	False
N	Int	0	False

Program blocks / System blocks / Program resources

Measurement_DB [DB12]

Measurement_DB Properties							
General							
Name	Measurement_DB	**Number**	12	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
y	Real	0.0	False
▼ Output			
r	Real	0.0	False
finish	Bool	false	False
InOut			
▼ Static			
r_array	Array[0..249] of Real		False
y_array	Array[0..249] of Real		False
i	Int	0	False

Program blocks / System blocks / Program resources

Model_DB [DB16]

Model_DB Properties							
General							
Name	Model_DB	**Number**	16	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
wejscie	Real	0.0	False
▼ Output			
wyjscie	Real	0.0	False
InOut			
▼ Static			
x	Array[0..5] of Real		False
s	Array[0..7] of Real		False
o	Array[0..7] of Real		False
s2	Real	0.0	False
i	Int	0	False
w1_1	Array[0..7] of Real		False
w1_2	Array[0..7] of Real		False
w1_3	Array[0..7] of Real		False
w1_4	Array[0..7] of Real		False
w1_5	Array[0..7] of Real		False
w1_6	Array[0..7] of Real		False
w_2	Array[0..7] of Real		False
bias	Array[0..7] of Real		False
bias2	Real	0.0	False
N	Int	0	False

Program blocks / System blocks / Program resources

Object_DB [DB13]

Object_DB Properties							
General							
Name	Object_DB	**Number**	13	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
r	Real	0.0	False
disruption	Real	0.0	False
▼ Output			
y	Real	0.0	False
InOut			
▼ Static			
x_array	Array[0..2] of Real		False
y_array	Array[0..2] of Real		False

Program blocks / System blocks / Program resources

PID_DB_1 [DB11]

PID_DB_1 Properties							
General							
Name	PID_DB_1	**Number**	11	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
SP	Real	0.0	False
PV	Real	0.0	False
MV	Real	0.0	False
kp	Real	0.0	False
ki	Real	0.0	False
kd	Real	0.0	False
▼ Output			
MV_PID	Real	0.0	False
InOut			
▼ Static			
ep	Array[0..1] of Real		False
de	Real	0.0	False
suma_ep	Real	0.0	False

Program blocks / System blocks / Program resources

Training_DB [DB10]

Training_DB Properties							
General							
Name	Training_DB	**Number**	10	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
error_stop_m	Real	0.0	False
error_stop_i	Real	0.0	False
epoch_stop_m	Real	0.0	False
epoch_stop_i	Real	0.0	False
training_m	Bool	false	False
training_i	Bool	false	False
▼ Output			
error_ep_m	Real	0.0	False
error_ep_i	Real	0.0	False
stop_m	Bool	false	False
stop_i	Bool	false	False
▼ InOut			
epoch	Real	0.0	False
▼ Static			
i	Int	0	False
long	Int	0	False
s	Array[0..7] of Real		False
o	Array[0..7] of Real		False
s2	Real	0.0	False
e2	Real	0.0	False
e	Array[0..7] of Real		False
x_m	Array[0..5] of Real		False
x_i	Array[0..5] of Real		False
n_m	Real	0.0	False
n_i	Real	0.0	False

Program blocks / System blocks / Program resources

On-Off_DB [DB20]

On-Off_DB Properties							
General							
Name	On-Off_DB	**Number**	20	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
SetPoint	Real	0.0	False
Hysteresis	Real	0.0	False
PV	Real	0.0	False
▼ Output			
MV	Real	0.0	False
InOut			
▼ Static			
UpperLimit	Real	0.0	False
LowerLimit	Real	0.0	False

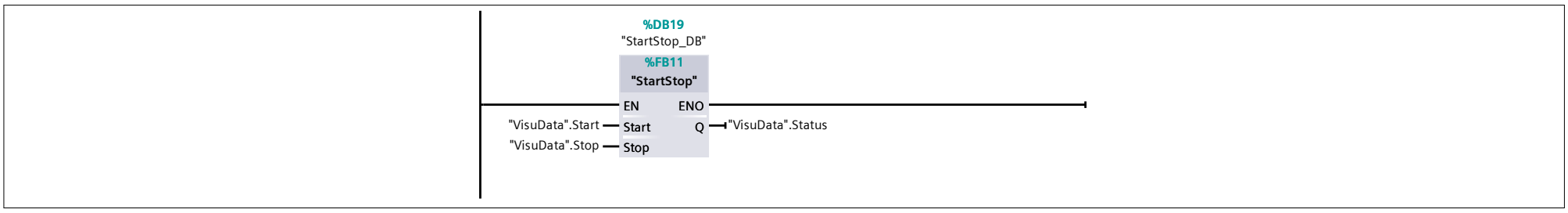
Program blocks / 00_Visu

VisuClass [FC8]

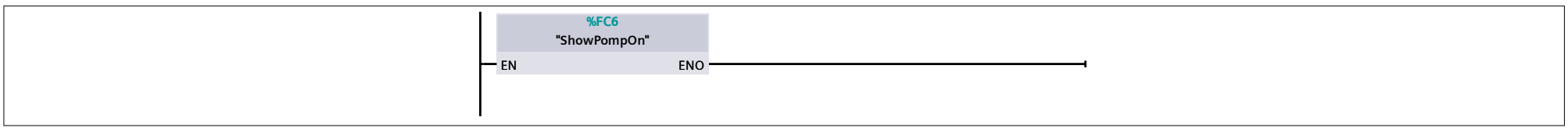
VisuClass Properties							
General							
Name	VisuClass	**Number**	8	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title	VisuClass	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
Temp		
Constant		
▼ Return		
VisuClass	Void	

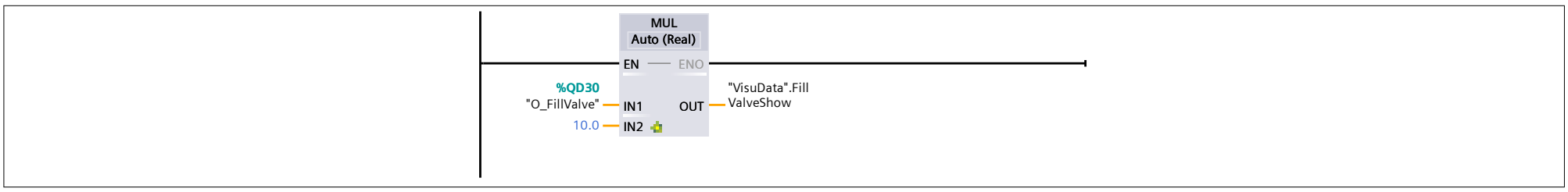
Network 1: Call: StartStop



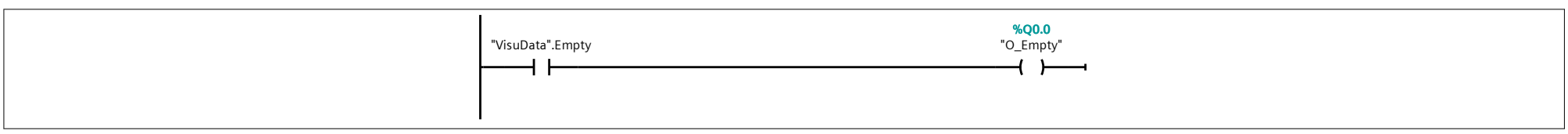
Network 2: Call: ShowPompOn



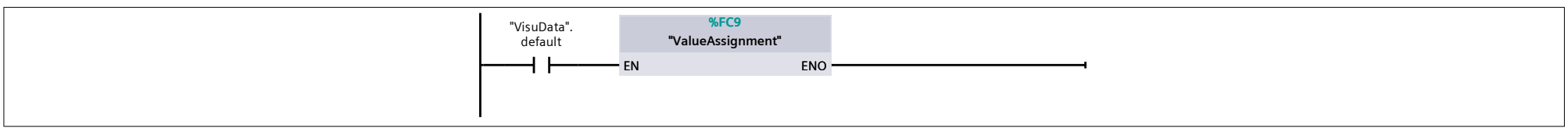
Network 3: Output: FillValveShow



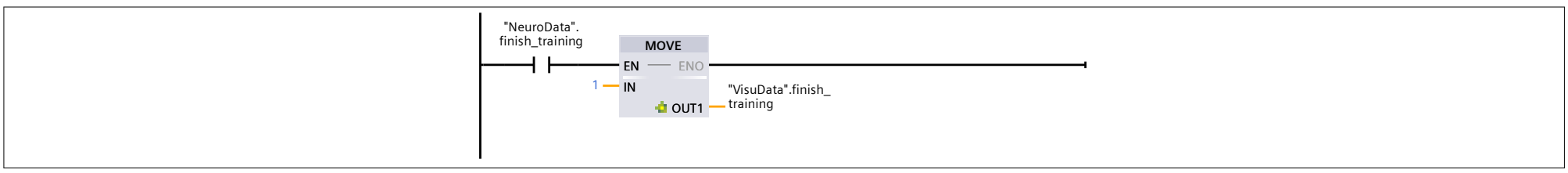
Network 4: Output: Empty



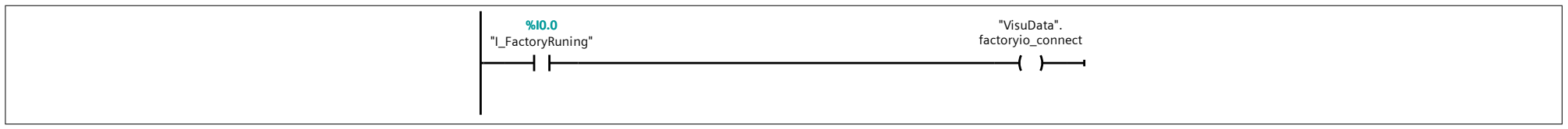
Network 5: Call: default -> ValueAssigment



Network 6: Show finish training neural network



Network 7: Show FactoryIO connection status


%I0.0
"I_FactoryRuning"
"VisuData".
factoryio_connect

Program blocks / 00_Visu

VisuData [DB9]

VisuData Properties							
General							
Name	VisuData	**Number**	9	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Static			
Start	Bool	false	False
Stop	Bool	false	False
Empty	Bool	false	False
Controller	Int	0	False
RandomDisturbance	Int	0	False
SetPoint	Real	0.0	False
Outflow	Real	0.0	False
LevelMeterShow	Real	0.0	False
SetPointShow	Real	0.0	False
FillValveShow	Real	0.0	False
TopPump	Int	0	False
LowPump	Int	0	False
Status	Bool	false	False
default	Bool	false	False
finish_training	Int	0	False
factoryio_connect	Bool	false	False

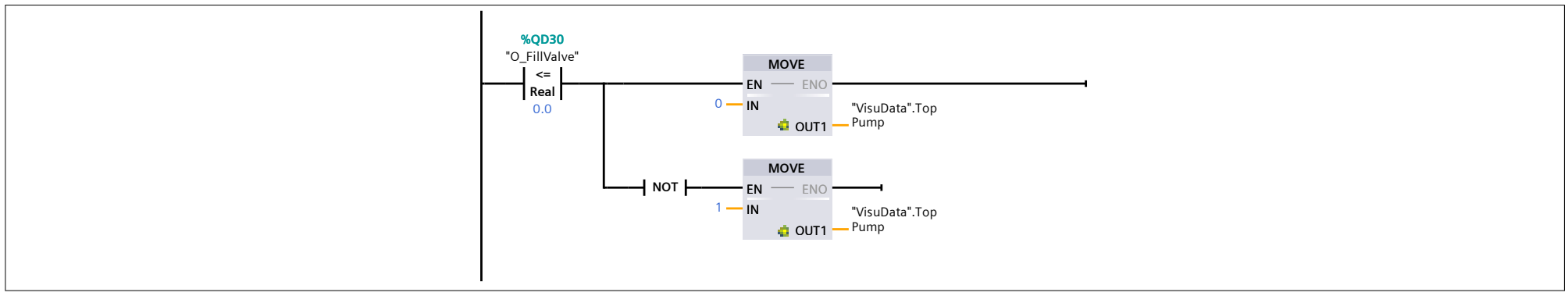
Program blocks / 00_Visu

ShowPompOn [FC6]

ShowPompOn Properties							
General							
Name	ShowPompOn	**Number**	6	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title	ShowPompOn	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
Output		
InOut		
Temp		
Constant		
▼ Return		
ShowPompOn	Void	

Network 1: Move: TopPump



Network 2: Move: LowPump