





















PLC tags

PLC tags									
	Name	Data type	Address	Retain	Access- ible from HMI/OPC UA/Web API	Writable from HMI/OPC UA/Web API	Visible in HMI engi- neering	Supervision	Comment
	Start (btn)	Bool	%I0.0	False	True	True	True		
	Reset (btn)	Bool	%I0.1	False	True	True	True		
	Stop (btn)	Bool	%I0.2	False	True	True	True		
	Factory I/O (Running)	Bool	%I0.3	False	True	True	True		
	Level Meter	Real	%ID30	False	True	True	True		
	Flow Meter	DWord	%ID34	False	True	True	True		
	Setpoint	DWord	%ID38	False	True	True	True		
	Start Light	Bool	%Q0.0	False	True	True	True		
	Reset Light	Bool	%Q0.1	False	True	True	True		
	Stop Light	Bool	%Q0.2	False	True	True	True		
	Fill Valve	Real	%QD30	False	True	True	True		
	Discharge Valve	Real	%QD34	False	True	True	True		
	Setpoint (Display)	DInt	%QD38	False	True	True	True		
	PV (Display)	DInt	%QD42	False	True	True	True		
	setpoint buffer	DWord	%MD100	False	True	True	True		
	Setpoint Value	Real	%MD104	False	True	True	True		
	level meter buffer	DWord	%MD108	False	True	True	True		
	PV Value	DWord	%MD112	False	True	True	True		
	Fill PID Output	Int	%MW116	False	True	True	True		
	fill pid output buffer	DWord	%MD120	False	True	True	True		

Totally Integrated Automation Portal

Main [OB1]

Main Properties

General

Name	Main	Number	1	Type	OB	Language	FBD
Numbering	Automatic						

Information

Title	"Main Program Sweep (Cycle)"	Author		Comment		Family	
Version	0.1	User-defined ID					

Name	Data type	Default value	Comment
▼ Input			
Initial_Call	Bool		Initial call of this OB
Remanence	Bool		=True, if remanent data are available
Temp			
Constant			

Network 1: Import FactoryIO handler

%FC9000

"MHJ-PLC-Lab-Function-S71500"

... — EN

ENO —

Network 2: Import Tank Level Controller

%FC1

"Tank_Level_Control"

... — EN

ENO —

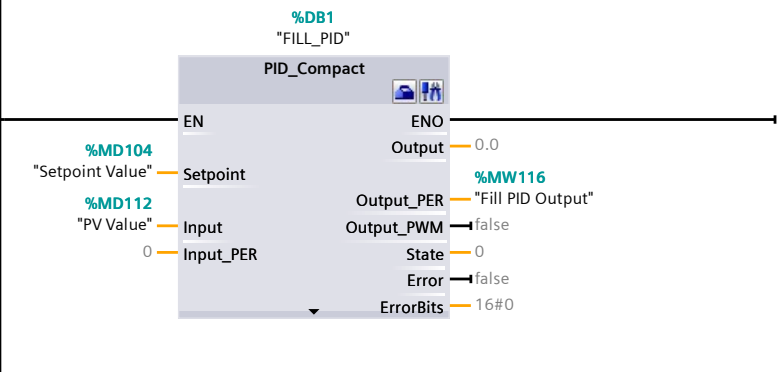
PID Controllers [OB30]

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

Name	Data type	Default value	Comment
▼ Input			
Initial_Call	Bool		Initial call of this OB
Event_Count	Int		Events discarded
Temp			
Constant			

Network 1: PID to fill tank according to setpoint

NOTE: We modified several settings for this PID to work. Namely:
Controller type set to "Length", "Cm", and "Automatic"
Input changed from "Input_PER" to "Input"
Process value upper limit changed to 300.0cm
Integral action time changed from 20.0s to 0.0s
PID -> PI (we don't really need the derivative in this case)

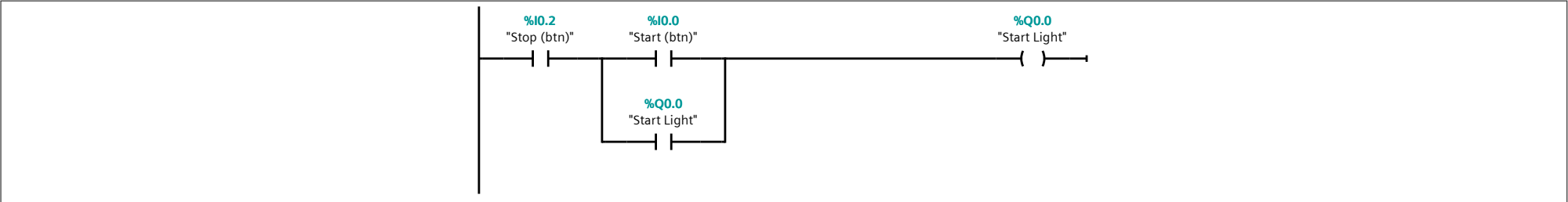


Tank_Level_Control [FC1]

Tank_Level_Control Properties							
General							
Name	Tank_Level_Control	Number	1	Type	FC	Language	LAD
Numbering	Automatic						
Information							
Title		Author		Comment	Networks 1-6 handle start- ing, stopping and resetting the process. Networks 7-9 manages our set point value and process variable value, which inter- act with a PID to handle how much voltage is sent to the fill valve.	Family	
Version	0.1	User-defined ID					

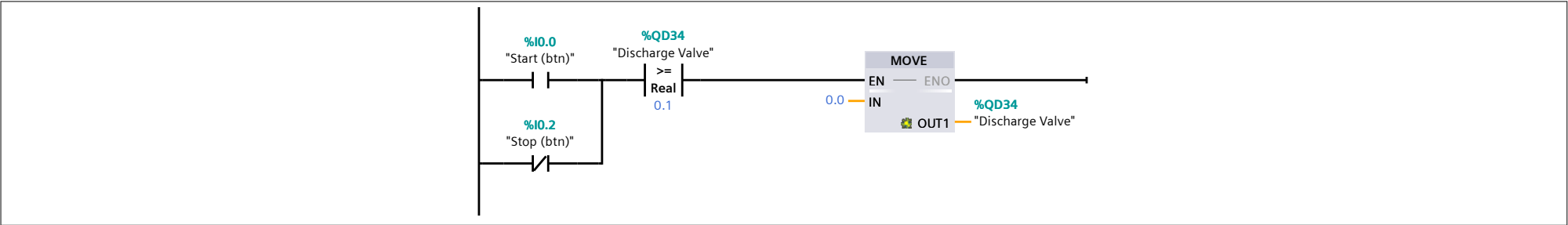
Name	Data type	Default value	Comment
Input			
Output			
InOut			
Temp			
Constant			
▼ Return			
Tank_Level_Control	Void		

Network 1: Start process

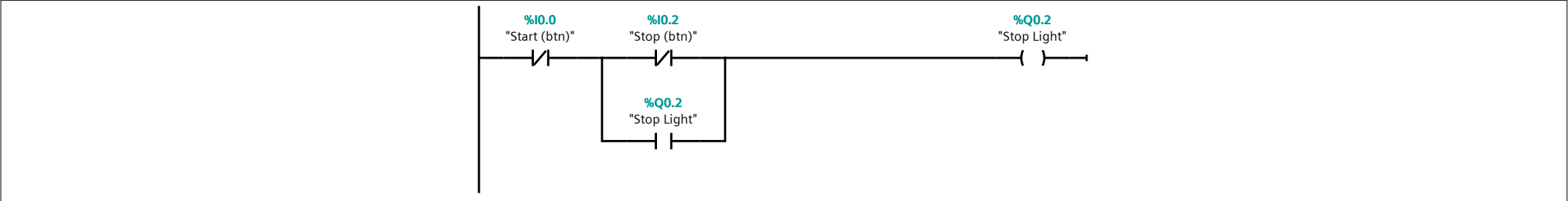


Network 2: Turn off discharge/drain valve

We'd be wasting water/chemicals if the discharge valve was on when starting the process. Additionally, we want to stop draining if the stop button is pressed.

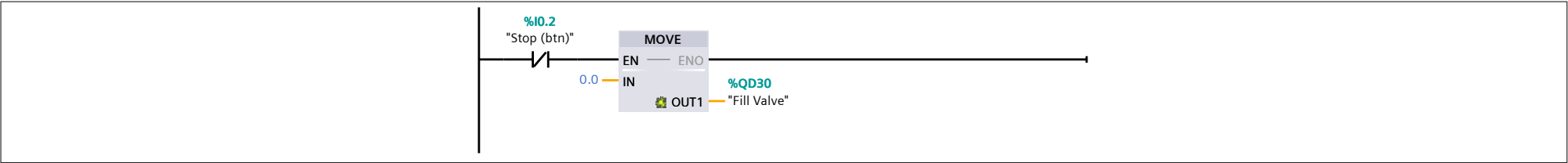


Network 3: Stop process



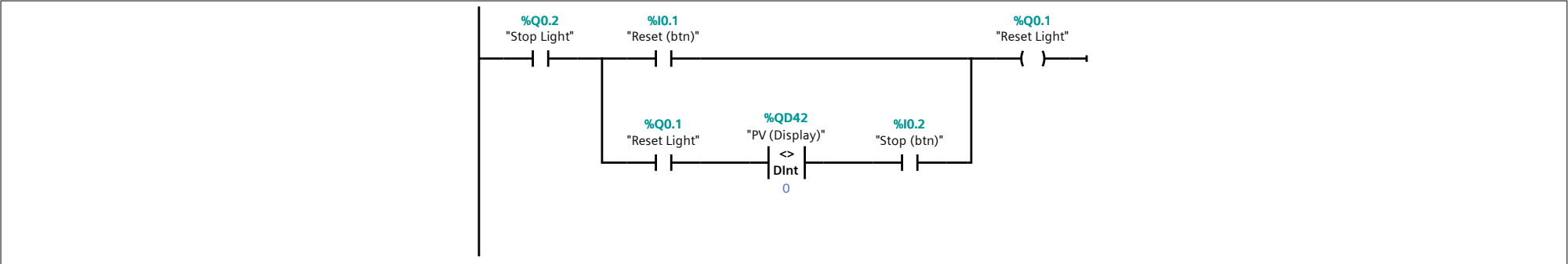
Network 4: Turn off fill valve

We want to immediately stop filling given operator intervention



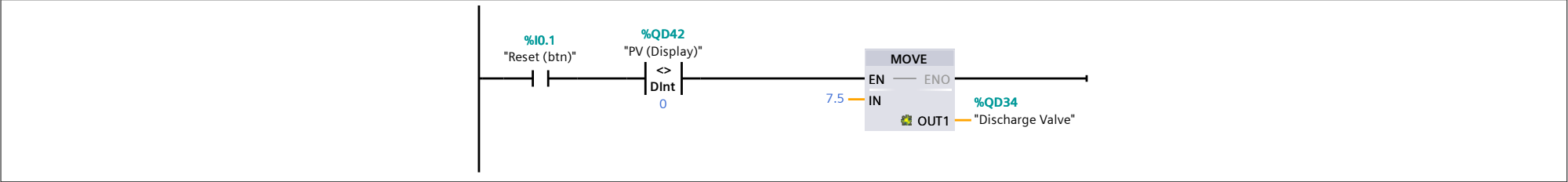
Network 5: Reset process

<> 0 so the reset light turns off once the tank is fully drained, or the stop button is pressed



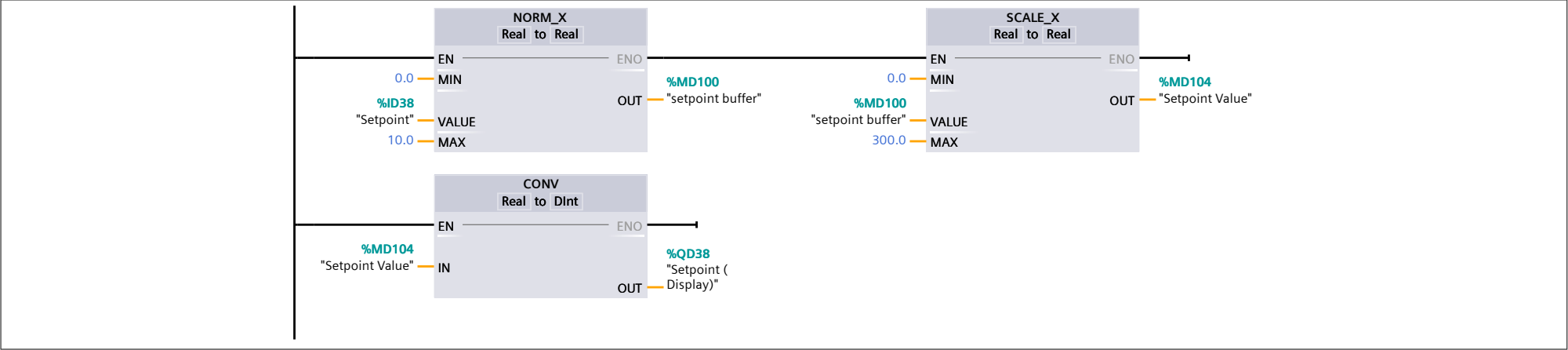
Network 6: Turn on discharge/drain valve

In the real world, we'd send in a raw integer value for the analog signal (0-27648 for SIMATIC PLCs, meaning 20736 in this case), but FactoryIO direct, 0-10V values only



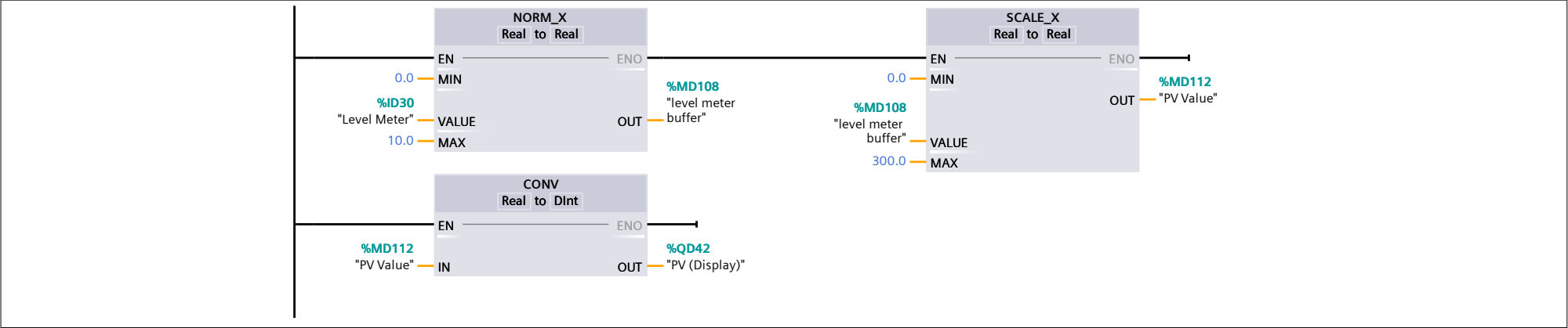
Network 7: Transfers Setpoint Potentiometer value to Setpoint Display on OIT

NORM_X: Potentiometer is analog and goes from [0.0V, 10.0V]
SCALE_X: Tank level is from [0.0cm, 300.0cm]. (Setpoint Value is also used within our PID)
CONV: Converts setpoint value from REAL to DINT for the Setpoint display on OIT



Network 8: Transfers Level Meter value to PV Display on OIT

NORM_X: Level Meter is analog and goes from [0.0V, 10.0V]
SCALE_X: Tank level is (again) from [0.0cm, 300.0cm], (PV Value is also used within our PID)
CONV: Converts PV (process variable, or basically tank level value) from REAL to DINT for the PV display on OIT



Network 9: Transfers PID output to Fill Valve

NORM_X: PID output goes from [0.0,27648.0]
MAX is 27648 because that's the maximum raw integer conversion for analog output for SIMATIC systems (which corresponds to 10V)
SCALE_X: In the real world the valve would be able to take a [0.0,27648.0] value, but in FactoryIO it requires the output to be to 0-10V.
We only want this to happen (i.e., the fill valve to start) if the process has been started by the operator.

