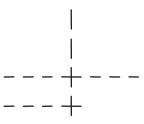
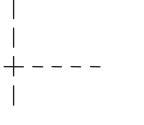
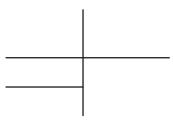
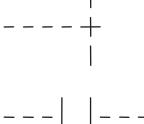
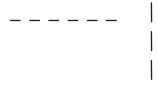
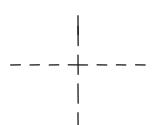
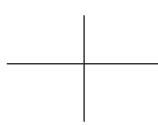
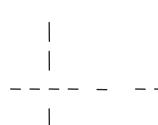
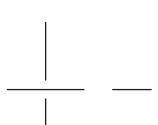
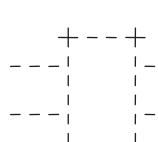
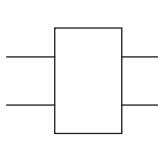
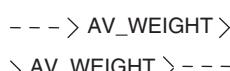
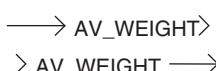


Appendix: Symbols

Ladder Programs

	<i>Semi-graphic form</i>	<i>Full graphic form</i>
A horizontal link along which power can flow	-----	_____
Interconnection of horizontal and vertical power flows	 	
Left-hand power connection of a ladder rung		
Right-hand power connection of a ladder rung		
Normally open contact	--- ---	--- ---
Normally closed contact	--- /---	--- /---
Positive transition-sensing contact, power flow occurs when associated variable changes from 0 to 1.	--- P---	--- P---
Negative transition-sensing contact, power flow occurs when associated variable changes from 1 to 0	--- N---	--- N---
Output coil: if the power flow to it is on then the coil state is on	---()---	---()---
Set coil	---(s)---	---(s)---
Reset coil	---(R)---	---(R)---
Retentive memory coil, the state of the associated variable is retained on PLC power fail	---(M)---	---(M)---

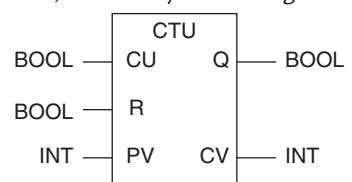
Function Blocks

	<i>Semi-graphic form</i>	<i>Full graphic form</i>
Horizontal and vertical lines		
Interconnection of horizontal and vertical signal flows		
Crossing horizontal and vertical signal flow		
Blocks with connections		
Connectors		

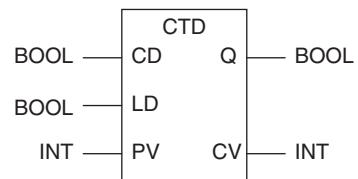
Commonly Encountered Blocks

BOOL is a Boolean signal, INT is an integer, REAL is a floating point number, ANY is any form of signal

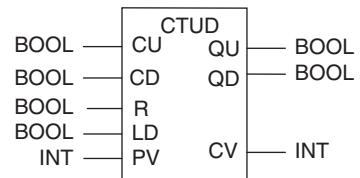
Up-counter counts the number of rising edges at input CU. PV defines the maximum value of the counter. Each new rising edge at CU increments CV by 1. Output Q occurs after set count. R is the reset.



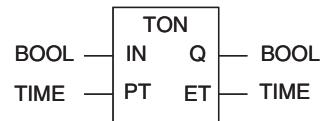
Down-counter counts down the number of rising edges at input CU. PV defines the starting value of the counter. Each new rising edge at CU decrements CV by 1. Output Q occurs when count reaches zero.



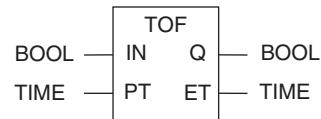
Up-down counter. It can be used to count up on one input and down on the other.



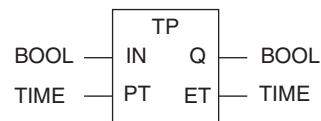
On-delay timer. When input IN goes true, the elapsed time at about ET starts to increase and when it reaches the set time, specified by input PT, the output Q goes true.



Off-delay timer. When input IN goes true, the output Q follows and remains true for the set time after which the input Q goes false.

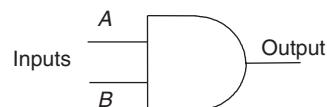
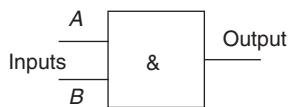


Pulse timer. When input IN goes true, output Q follows and remains true for the pulse duration specified by input PT.

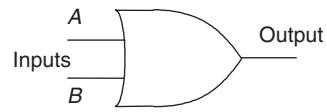
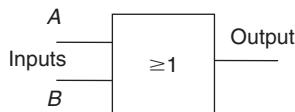


Logic Gates

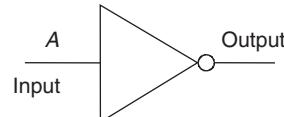
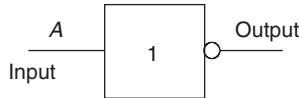
AND gate



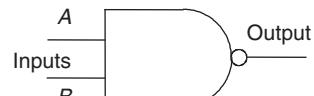
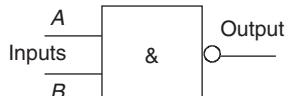
OR gate



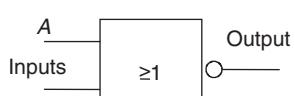
NOT gate

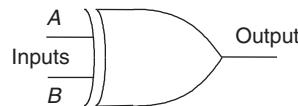
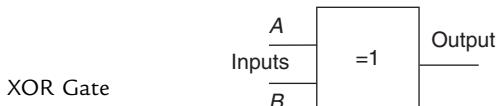


NAND gate



NOR Gate





Sequential Function Charts

Start step. This defines the step which will be activated when the PLC is cold-started.



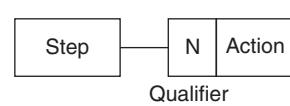
Transition condition. Every transition must have a condition. One that always occurs should be shown with the condition TRUE.



Step in a program

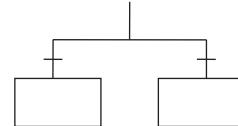


Every step can have an associated action. An action describes the behavior that occurs when the step is activated. Each action can have a qualifier: N indicates the action is executed while the step is active. If no qualifier is indicated it is taken to be N.

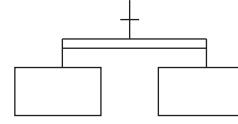


D: time-delayed action which starts after a given time.

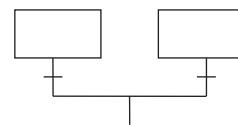
Selective branching



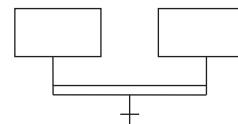
Parallel branching when the transition occurs



Convergence when both transitions occur



Simultaneous convergence



Instruction List (IEC 61131-3 Symbols)

LD	Start a rung with an open contact
LDN	Start a rung with a closed contact
ST	An output
S	Set true
R	Reset false
AND	Boolean AND
ANDN	Boolean NAND
OR	Boolean OR
ORN	Boolean NOR
XOR	Boolean XOR
NOT	Boolean NOT
ADD	Addition
SUB	Subtraction
MUL	Multiplication
DIV	Division

Structured Text

X:= Y Y represents an expression that produces a new value for the variable X.

Operators

(...) Parenthesized (bracketed) expression

Function(...) List of parameters of a function

** Raising to a power

-, NOT Negation, Boolean NOT

*, /, MOD Multiplication, division, modulus operation

+, - Addition, subtraction

<, >, <=, >= Less than, greater than, less than or equal to, greater than or equal to

=, <> Equality, inequality

AND, & Boolean AND

XOR Boolean XOR

OR Boolean OR

Conditional and Iteration Statements

IF . . . THEN . . . ELSE is used when selected statements are to be executed when certain conditions occur.

The FOR . . . DO iteration statement allows a set of statements to be repeated, depending on the value of the iteration integer variable.

The WHILE . . . DO iteration statement allows one or more statements to be executed while a particular Boolean expression remains true.

The REPEAT . . . UNTIL iteration statement allows one or more statements to be executed and repeated while a particular Boolean expression remains true.