USER MANUAL

LONGO Programmable Controller
LPC Manager

Version 4

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LONGO Programmable Controller LPC Manager

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1 ABOUT THIS DOCUMENT

LPC Manager user manual describes how to use application *LPC Manager*.

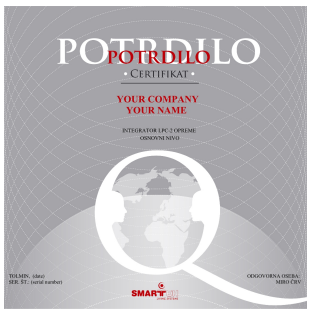
1.1 Who Should Read This Document

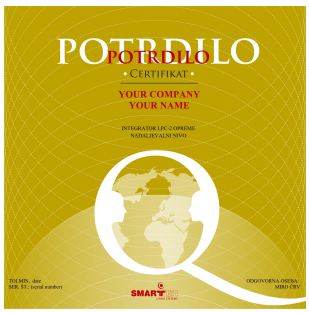
If you are new to the *LPC Manager* software and want to get started with it or upgrading from previous versions then You should read this document.

In order to properly understand this document, it is necessary to understand at least basics of the *LPC* hardware. For this it is highly recommended to view *LPC Getting Started* video (installed with *LPC Smarteh IDE setup*) or to go through the proper training to a certified SMARTEH d.o.o. trainer. On this short course you will learn all the basics and have the opportunity to become a certified SMARTEH d.o.o. integrator. Not only you will get a head start, but you will also become a part of the growing group of LPC users, get a chance to ask direct questions to experts, get contacts with other integrators and companies all over the world...

NOTE: Since *LPC Manager* is based on *IEC 61131-3 international standard*, please refer to *PLC* (programming logic controllers) programming languages *International Standard IEC 61131-3 f*or more detailed information.

For more information, call *+386 5 388 44 00* or e-mail to *info@smarteh.si* and reserve your ticket for the LPC certificate training:





1.2 Terminology

Throughout this manual, various phrases are used. Here is a description of some of them.

1.2.1 LPC Family products based terminology

LONGO™

... is a family of products (hardware and software) and is a trademark of SMARTEH d.o.o.

LPC™

... Longo Programming Controller and is a trademark of SMARTEH d.o.o.

IDE

… is a **integrated development environment.**

LPC-2 Programming Controller

... is a family of hardware modules (MCU module, I/O modules and other modules).

LPC Smarteh IDE, LPC Manager

... are members of LPC family software.

1.2.2 LPC Manager based terminology

Beremiz

… is a free software framework for automation (http://www.beremiz.org)

IEC 61131-3

… is an international standard for programmable controllers, programmable languages

PLC

… Programmable Logic Controller

MCU

… Main Control Unit

POU

… Program Organization Unit

Programming Languages

- IL … Instruction List
- ST … Structured Text
- LD … Ladder Diagram
- FBD … Function Block Diagram
- SFC … Sequential Function Chart

True

… Logical 1, on, active, high state

False

… Logical 0, off, not active, low state

1.2.3 Conventions used in this document

Items appearing in this document are sometimes given a special appearance to set them apart from the regular text. Here's how they look:

Italic
Used for marking important keywords.

NEW:
Used to mark sections which changed most from previous versions.

2 LPC MANAGER SOFTWARE

2.1 Introduction

LPC Manager software (LONGO Programmable Controller Manager software) is a product that is used for programming LPC-2 family of Smarteh controllers.

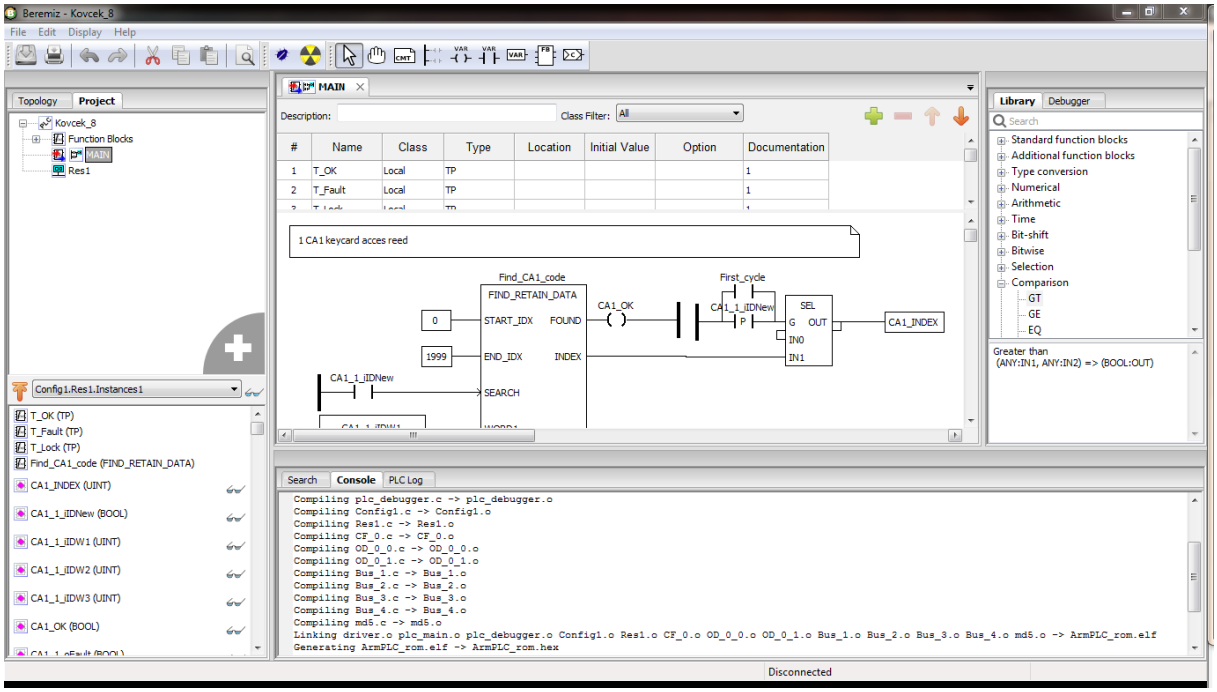
After creating a configuration in LPC Smarteh IDE, LPC Manager can be started by:

– click on *Program* button, or

– select a project configuration and then click on *Program in LPC Manager* command line.

Software is based on Beremiz open source software adapted to Smarteh LPC controllers, which supports IEC 61131-3 standard programming languages IL(instruction list), ST(structured text), LD(ladder diagram), FBD(function block diagram) and SFC(sequential function chart).

LPC manager software is easy to use and offers many possibilities in programming, debugging, monitoring and trending LPC controllers application software.



2.2 LPC Manager editor

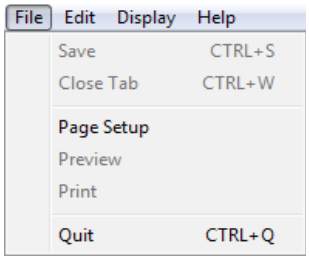
LPC Manager software consists of:

- *Main menu:* File, Edit, Display, Help
- *Tool bars:* Save, Print, Undo, Redo, Cut, Copy, Paste, Search in Project;
  Simulate, Debug;
  Select and object, Move the view, Create a new comment, Create a new variable, Create a new block, Create a new connection
- Topology and Project window
- *Variables and* Editor workspace window
- *Search, Console and PLC Log window*
- *Library and Debugging window*

2.3 Main menu

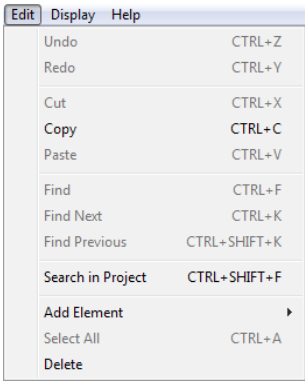
In main menu you can find options *File*, *Edit*, *Display*, and *Help*

2.3.1 File



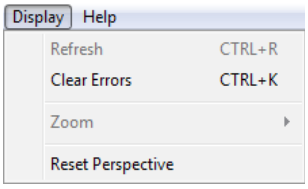
Save	-Save currently open workspace.
Close Tab	-Close currently open workspace.
Page Setup	-Setup page for printing.
Preview	-Printing preview of workspace.
Print	-Print currently open workspace.
Quit	-Exit *LPC Manager*.

2.3.2 Edit



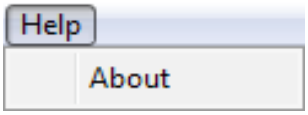
Undo	-Undo last change in workspace.
Redo	-Redo reverts the effects of the undo action.
Cut	-Cut the selected element in workspace.
Copy	-Copy the selected element in workspace.
Paste	-Paste (previously copied) element(s) in the workspace.
Find	-Search elements
Find Next	-Search next element
Find Previous	-Search previous element
Search in Project	-Search elements in the project.
Add Element	-Add element (Data Type, Function, Function Block, Program, Configuration) into an appropriate item under *Types* window.
Select All	-Select all elements in workspace.
Delete	-Delete element from workspace.

2.3.3 Display



Refresh	-Refresh workspace.
Clear Errors	-Clear program errors
Zoom	-Window zoom settings (12 .. 800%).
Reset Perspective	-Reset program windows to default

2.3.4 Help

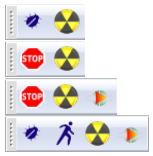


About	-Main information about Beremiz.

2.4 Toolbars

Toolbar1

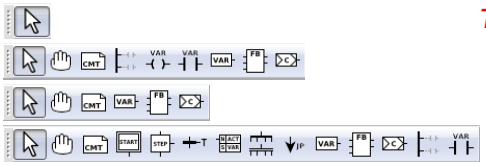
-Standard windows icons (Save, Print, Undo, Redo, Cut, Copy, Paste, Search in Project).



In Off-line mode
In Simulation mode
In Application mode
In Bootloader mode

Toolbar2

-PLC related execution functions *(set of elements depends on the connection to USB or simulation).*



Toolbar3

-Main graphical icons for editor workspace elements (set of elements depends on the selected programming language).

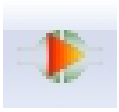
Toolbar2

Simulate PLC

Pressing the *"Simulate"* button to start PLC emulation running on PC. All debugging functions are supported, same like in online debugging mode while connected to an LPC-2 controller.

Build project into build folder

Press the "*Build*" button to start building the project. The "Log Console" displays different building steps. The build results in an executable code, named as the project name. It's located in the build directory of the project.



Transfer PLC

This and following commands are only available when PC is connected to the LPC-2 controller using USB programming cable and if blue LED, representing USB connectivity, is on.

Press the "*Transfer*" button to transfer executable application code to the LPC-2 controller.

Start PLC

This command is active, when operation mode switch on the connected LPC-2 controller is in the "*RUN*" position. By pressing the "*Run*" button, the controller will start to execute the application. Green "*RUN*" LED will switch on.

Stop running PLC

By pressing the "*Stop*" button, the connected LPC-2 controller will stop all LPC-2 controller processes. The green "*RUN*" LED and connected modules outputs will go to off state.

Toolbar3

Select an object

Standard tool to select one or more objects inside POU.

Move the view

Move current view inside POU to the desired direction.

Available for LD, FBD and SFC.

Create a new comment

Insert a new comment into POU.

Available for LD, FBD and SFC.

Create a new power rail

Insert a power rail (left or right) into POU.

Available for LD and SFC.

Create a new coil

Insert a coil into POU.

Available for LD.

Create a new contact

Insert a contact into POU.

Available for LD and SFC.

Create a new variable

Insert a variable into POU.

Available for LD and SFC.

Create a new block

Insert a block into POU.

Available for LD, FBD and SFC.

Create a new connection

Insert a connection into POU.

Available for LD, FBD and SFC.

Create a new initial step

Insert an initial step into POU.

Available for SFC.

Create a new step

Insert a new step into POU.

Available for SFC.

Create a new transition

Insert a transition into POU.

Available for SFC.

Create a new action block

Insert an action block into POU.

Available for SFC.

Create a new divergence

Insert a divergence into POU.

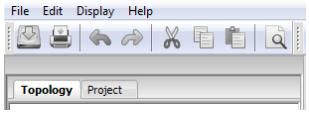
Available for SFC.

Create a new jump

Insert a jump into POU.

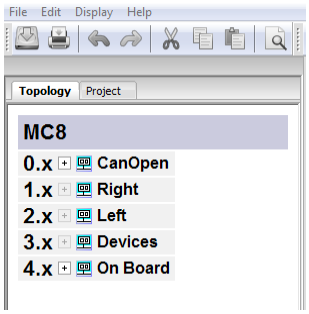
Available for SFC.

2.5 Project window



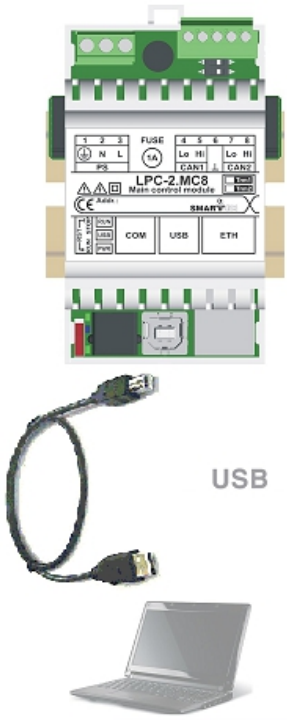
Project window -Group of windows which consist of Topology and Project described below.

2.5.1 Topology



Topology	-Represents all variables of current controller configuration, composed by LPC Smarteh IDE software.
Project name (MC8)	-the name of the project defined in LPC Smarteh IDE configuration
CanOpen	-CANopen variables and communication settings.
Right	-Input and output modules variables.
Left	-Networking modules variables.
Devices	-Intelligent peripheral modules variables
On Board	-MCU on board variables.

Build - Transfer procedure



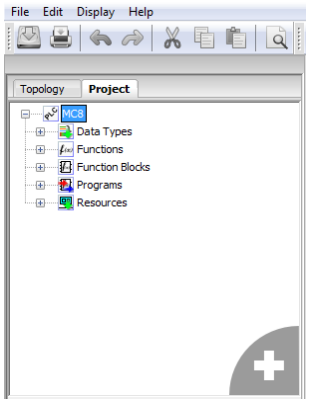
When the *LPC Manager* is opened for the first time (for the correspondent LPC Smarteh IDE configuration) there are two buttons available inside Toolbar 2: *Simulate* and *Build*. After the required application is created inside POU, then this application must be built. This procedure can be observed inside Console window. If the code is error free then the correspondent files are generated inside project folder.

The next step is to transfer the generated binary code inside LPC-2 controller which must be connected to the USB port via USB programming cable (USB type A male to USB type B male, see example picture on the left). Now the USB connectivity (blue) LED is on and in the Toolbar 2 button *Transfer* is added and *Simulate* is change to *Stop*. Click on Transfer button and observe the progress in LOG console window. If everything is OK then the message "PLC transferred successfully" is reported and the controller is started automatically (green RUN LED is on).

If you have problems transferring program to MCU, switch MCU to STOP position (Controller will enter into bootloader mode and green "*RUN*" LED should be off) and then press transfer again.

Important: Upon transfer, all the internal memory (retain data, RTC, ...) is erased.

2.5.2 Project (program structure window)



Project (MC8) -Main project properties and descriptions (*Project*, *Author*, *Graphics*, *Miscellaneous)*

Data Types -User defined data types *(Directly, Subrange, Enumerated, Array, Structure)*.

Functions User defined POU function *(IL, ST, LD, FBD)*

Function Blocks User defined POU function blocks *(IL, ST, LD, FBD, SFC)*.

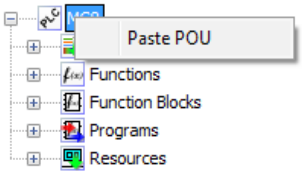
Programs POU programs *(IL, ST, LD, FBD, SFC)*.

Resources Contains variable list (global variables), tasks and instances (for execution of the POU programs in the project).

Add new (DataTypes, Functions, Function Blocks, Programs and Resources)

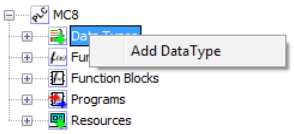
New POU -New POU can be added by clicking on the big plus in the bottom right corner. POU type and programming language must be defined. A POU name can be changed.

Right-click menu (Project name)

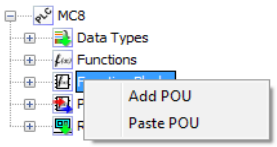


Paste POU -Copied POU (e.g. Function block) can be pasted inside correspondent *Types* section. POU can also be imported from a text file (previously exported POU).

Right-click menu (DataTypes, Functions, Function Blocks, Programs and Resources)

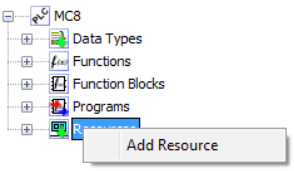


Add DataType -New *DataType* can be created.



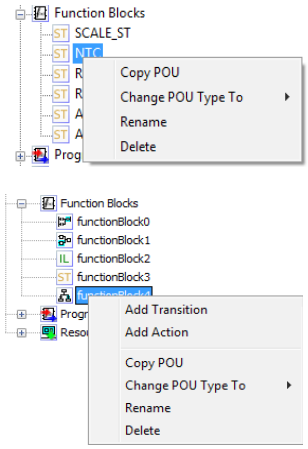
Add POU -New POU can be created. Programming language must be defined. A POU name and POU type can be changed.

Paste POU -Copied POU (e.g. Function block) can be pasted inside correspondent *Types* section. POU can also be imported from a text file (previously exported POU).



Add Resources -New Resources can be created.

Right-click menu (Function, Function block and Program)



Contains of the Right-click menu(Function block) depends on a programming language and type of POU.

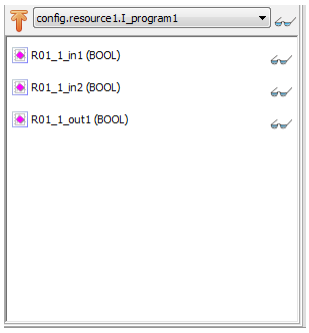
Add transition	*-(only for SFC language)*
Add action	*-(only for SFC language)*
Copy POU	-Function block can be copied (pasted) inside *Function Blocks* section.
Change POU Type To	-POU type of the selected Function can be changed to a Function block or *Program and Function block can be changed to Program*.
Rename	-Rename selected Function block.
Delete	-Delete selected Function block.

***HINT**: The content of the copied Function block (clipboard) can be saved into a text file for backup or use in other LPC Manager applications.*

Double-click (Project name, DataTypes, Functions, Function Blocks, Programs and Resources)

- Double-click on any data type or POU opens selected data type or POU in editor workspace.
- Double-click on project name opens a *Config variables* and *Project properties* in editor workspace.

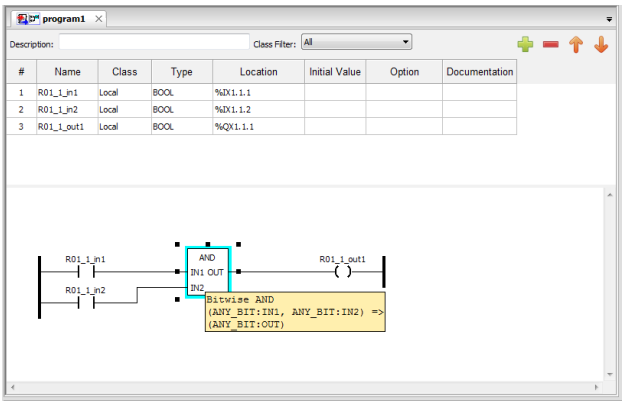
2.5.3 Project (instances window)



Instances

-Contains image of built and transferred application to the target LPC-2 controller. It is used for graphical presentation in on line graphical debugging mode. All variables and internal logic connections can be animated in editing work space as logic structure, value in the list inside debugging window or in real time graphical trend window.
Debugging can be started by clicking on glasses.
Variables can be forced to the desired value.

2.5.4 Editor workspace



Editor workspace

-Used for editing, setting, programming and debugging of all elements in the project window (POUs, data types, configurations, resources, topology and other variables, instances,...). Edit elements are opened in a separate window from those that are listed in the workspace.

SHORTCUTS: **CTRL+Scroll Up** Zoom In
CTRL+Scroll Down Zoom Out
CTRL+Down Arrow Scroll toward bottom
CTRL+Up Arrow Scroll toward top
CTRL+Right Arrow Scroll toward right
CTRL+Left Arrow Scroll toward left
Double click the connection line between elements to optimize the connection line length (shortest line)
CTRL+C, CTRL+V Copy - Paste element(s) (click on the selected position before pressing CTRL+V; cursor has a shape as cross)

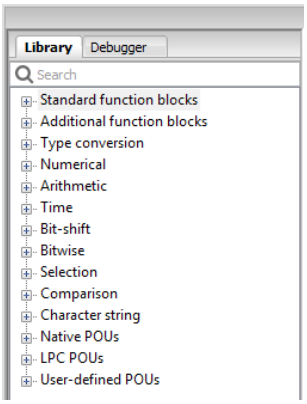
WARNING! *Usage of non-standard characters (e.g. č, š, ž,...) in editing fields can cause editor functioning problems.*

HINT: *By placing the cursor on the desired block then a name of the block and correspondent variables are shown inside a small pop-up window beside cursor.*

VARIABLES -Variables window contains all used variables of related POUs, providing a means of identifying data objects with its' elementary data type declaration.

SHORTCUT: **Double click** on the Type field opens a pop-up bar to select Base type or User Data type of the variable.

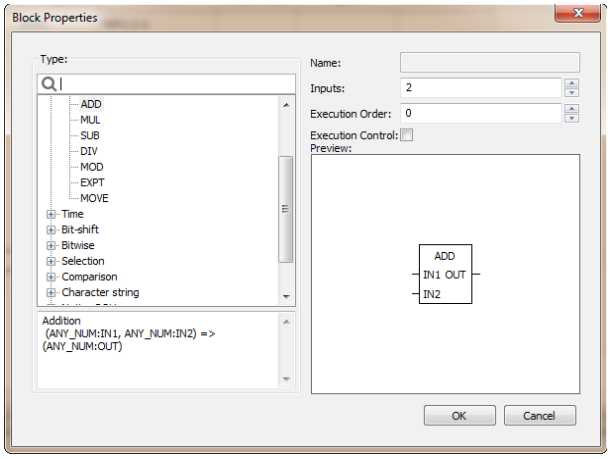
2.6 Library



Library

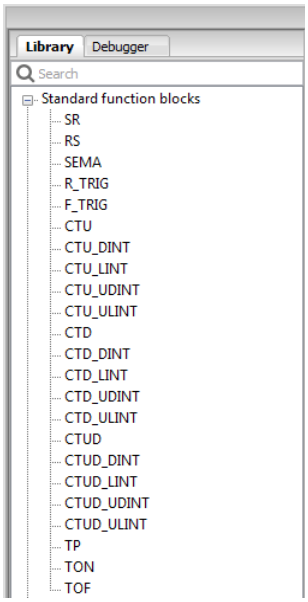
-Library contains various groups of standard and user defined functions. They support the usage in different programmable controller programming languages inside POUs.

BLOCK PROPERTIES

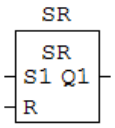


Block Properties pop-up window can be opened by double-click on function block. Some of the blocks can have more inputs than default. This is selectable in the *Inputs* field (e.g. ADD block). Also an *Execution Order* of the blocks can be programmer-defined. All blocks have an additional *Execution Control* check-box. If it is checked than two new pins are added (EN – input and ENO – output) to control dynamically their execution.

2.6.1 Standard function blocks



SR



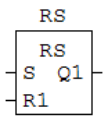
SR bistable

The SR bistable is a latch where the Set dominates.

(BOOL:S1, BOOL:R) => (BOOL:Q1)

This function represents a standard set-dominant set/reset flip flop. The Q1 output become TRUE when the input S1 is TRUE and the R input is FALSE. In the same way, the Q1 output become FALSE when the input S1 is FALSE and the R input is TRUE. After one of these transitions, when both the S1 and R signals return to FALSE, the Q1 output keeps the previous state until a new condition occurs. If you apply a TRUE condition for both the signals, the Q1 output is forced to TRUE (set-dominant).

RS



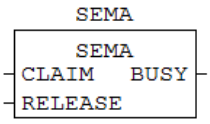
RS bistable

The RS bistable is a latch where the Reset dominates.

(BOOL:S, BOOL:R1) => (BOOL:Q1)

This function represents a standard reset-dominant set/reset flip flop. The Q1 output become TRUE when the input S is TRUE and the R1 input is FALSE. In the same way, the Q1 output become FALSE when the input S is FALSE and the R1 input is TRUE. After one of these transitions, when both the S and R1 signals return to FALSE, the Q1 output keeps the previous state until a new condition occurs. If you apply a TRUE condition for both the signals, the Q1 output is forced to FALSE (reset-dominant).

SEMA



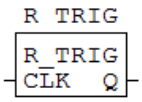
Semaphore

The semaphore provides a mechanism to allow software elements mutually exclusive access to certain resources.

(BOOL:CLAIM, BOOL:RELEASE) => (BOOL:BUSY)

This function block implements a semaphore function. Normally this function is used to synchronize events. The BUSY output is activated by a TRUE condition on the CLAIM input and it is de-activated by a TRUE condition on the RELEASE input.

R TRIG



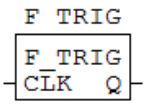
Rising edge detector

The output produces a single pulse when a rising edge is detected.

(BOOL:CLK) => (BOOL:Q)

This function is a rising-edge detector. The Q output becomes TRUE when a 0 to 1 (or FALSE to TRUE or OFF to ON) condition is detected on the CLK input and it sustains this state for a complete scan cycle.

F TRIG



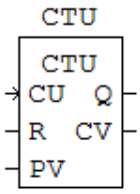
Falling edge detector

The output Q produces a single pulse when a falling edge is detected.

(BOOL:CLK) => (BOOL:Q)

This function is a falling-edge detector. The Q output becomes TRUE when a 1 to 0 (or TRUE to FALSE or ON to OFF) condition is detected on the CLK input and it sustains this state for a complete scan cycle.

CTU
CTU_DINT, CTU_LINT, CTU_UDINT, CTU_ULINT



Up-counter

The up-counter can be used to signal when a count has reached a maximum value.

CTU: (BOOL:CU, BOOL:R, INT:PV) => (BOOL:Q, INT:CV)

CTU_DINT: (BOOL:CU, BOOL:R, DINT:PV) => (BOOL:Q, DINT:CV)

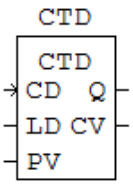
CTU_LINT: (BOOL:CU, BOOL:R, LINT:PV) => (BOOL:Q, LINT:CV)

CTU_UDINT: (BOOL:CU, BOOL:R, UDINT:PV) => (BOOL:Q, UDINT:CV)

CTU_ULINT: (BOOL:CU, BOOL:R, ULINT:PV) => (BOOL:Q, ULINT:CV)

The CTU function represents an up-counter. A rising-edge on CU input will increment the counter by one. When the programmed value, applied to the input PV, is reached, the Q output becomes TRUE. Applying a TRUE signal on R input will reset the counter to zero (Asynchronous reset). The CV output reports the current counting value.

CTD
CTD_DINT, CTD_LINT, CTD_UDINT, CTD_ULINT



Down-counter

The down-counter can be used to signal when a count has reached zero, on counting down from a pre-set value.

CTD: (BOOL:CD, BOOL:LD, INT:PV) => (BOOL:Q, INT:CV)

CTD_DINT: (BOOL:CD, BOOL:LD, DINT:PV) => (BOOL:Q, DINT:CV)

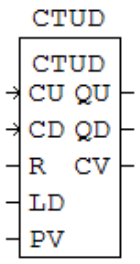
CTD_LINT: (BOOL:CD, BOOL:LD, LINT:PV) => (BOOL:Q, LINT:CV)

CTD_UDINT: (BOOL:CD, BOOL:LD, UDINT:PV) => (BOOL:Q, UDINT:CV)

CTD_ULINT: (BOOL:CD, BOOL:LD, ULINT:PV) => (BOOL:Q, ULINT:CV)

The CTD function represents a down-counter. A rising-edge on CD input will decrement the counter by one. The Q output becomes TRUE when the current counting value is equal or less than zero. Applying a TRUE signal on LD (LOAD) input will load the counter with the value present at input PV (Asynchronous load). The CV output reports the current counting value.

CTUD
CTUD_DINT,
CTUD_LINT,
CTUD_UDINT,
CTUD_ULINT



Up-down counter

The up-down counter has two inputs CU and CD. It can be used to both count up on one input and down on the other.

CTUD: (BOOL:CU, BOOL:CD, BOOL:R, BOOL:LD, INT:PV) => (BOOL:QU, BOOL:QD, INT:CV)

CTUD_DINT: (BOOL:CU, BOOL:CD, BOOL:R, BOOL:LD, DINT:PV) => (BOOL:QU, BOOL:QD, DINT:CV)

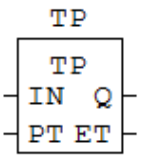
CTUD_LINT: (BOOL:CU, BOOL:CD, BOOL:R, BOOL:LD, LINT:PV) => (BOOL:QU, BOOL:QD, LINT:CV)

CTUD_UDINT: (BOOL:CU, BOOL:CD, BOOL:R, BOOL:LD, UDINT:PV) => (BOOL:QU, BOOL:QD, UDINT:CV)

CTUD_ULINT: (BOOL:CU, BOOL:CD, BOOL:R, BOOL:LD, ULINT:PV) => (BOOL:QU, BOOL:QD, ULINT:CV)

This function represents an up-down programmable counter. A rising-edge on the CU (COUNT-UP) input increments the counter by one while a rising-edge on the CD (COUNT-DOWN) decreases the current value. Applying a TRUE signal on R input will reset the counter to zero. A TRUE condition on the LD signal will load the counter with the value applied to the input PV (PROGRAMMED VALUE). QU output becomes active when the current counting value is greater or equal to the programmed value. The QD output becomes active when the current value is less or equal to zero.
The CV output reports the current counter value.

TP



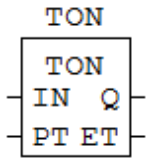
Pulse timer

The pulse timer can be used to generate output pulses of a given time duration.

(BOOL:IN, TIME:PT) => (BOOL:Q, TIME:ET)

This kind of timer has the same behaviour of a single-shot timer or a monostable timer.
When a rising-edge transition is detected on the IN input, the Q output becomes TRUE immediately. This condition continues until the programmed time PT, applied to the relative pin, is elapsed. After that the PT is elapsed, the Q output keeps the ON state if the input IN is still asserted else the Q output returns to the OFF state. This timer is not re-triggerable. This means that after that the timer has started it can't be stopped until the complete session ends. The ET output reports the current elapsed time.

TON



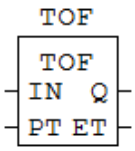
On-delay timer

The on-delay timer can be used to delay setting an output true, for fixed period after an input becomes true.

(BOOL:IN, TIME:PT) => (BOOL:Q, TIME:ET)

Asserting the input signal IN of this function starts the timer. When the programmed time, applied to the input PT, is elapsed and the input IN is still asserted, the Q output becomes TRUE. This condition will continue until the input IN is released. If the IN input is released before time elapsing, the timer will be cleared. The ET output reports the current elapsed time.

TOF



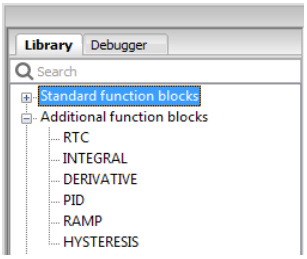
Off-delay timer

The off-delay timer can be used to delay setting an output false, for fixed period after input goes false.

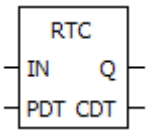
(BOOL:IN, TIME:PT) => (BOOL:Q, TIME:ET)

Asserting the input signal IN of this function immediately activates the Q output. At this point, releasing the input IN will start the time elapsing. When the programmed time, applied to the input PT, is elapsed and the input IN is still released, the Q output becomes FALSE. This condition will be kept until the input IN is released. If the IN input is asserted again before time elapses, the timer will be cleared and the Q output remains TRUE. The ET output reports the current elapsed time.

2.6.2 Additional function block



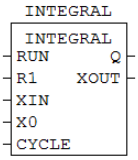
RTC



RTC

Functioning is not supported by our PLC.

INTEGRAL



Integral

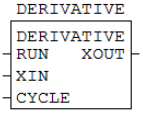
The integral function block integrates the value of input XIN over time.

(BOOL:RUN, BOOL:R1, REAL:XIN, REAL:X0, TIME:CYCLE) =>
(BOOL:Q, REAL:XOUT)

When input RUN is True and override R1 is False, XOUT will change for XIN value depends on CYCLE time value sampling period. When RUN is False and override R1 is True, XOUT will hold the last output value. If R1 is True, XOUT will be set to the X0 value.

XOUT = XOUT + (XIN * CYCLE)

DERIVATIVE



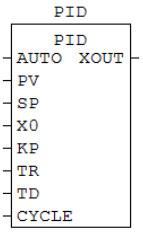
Derivative

The derivative function block produces an output XOUT proportional to the rate of change of the input XIN.

(BOOL:RUN, REAL:XIN, TIME:CYCLE) => (REAL:XOUT)

When RUN is True, XOUT will change proportional to the rate of changing of the value XIN depends on CYCLE time value sampling period.
XOUT = ((3 * (XIN - $XIN_{(to-3)}$)) + $XIN_{(to-1)}$ - $XIN_{(to-2)}$) / (10 * CYCLE)

PID



PID

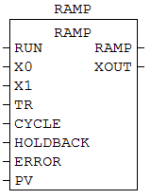
The PID (Proportional, Integral, Derivative) function block provides the classical three term controller for closed loop control. It does not contain any output limitation parameters (dead-band, minimum, maximum, …) or other parameters normally used for real process control (see also PID_A).

(BOOL:AUTO, REAL:PV, REAL:SP, REAL:X0, REAL:KP, REAL:TR, REAL:TD, TIME:CYCLE) => (REAL:XOUT)

When AUTO is False, PID function block XOUT will follow X0 value. When AUTO is True, XOUT will be calculated from error value (PV process variable – SP set point), KP proportional constant, TR reset time, TD derivative constant and CYCLE time value sampling period.

XOUT = KP * ((PV-SP) + (I_OUT/TR) + (D_OUT * TD))

RAMP



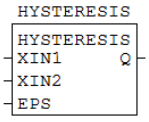
Ramp

The RAMP function block is modelled on example given in the standard but with the addition of a 'Holdback' feature.

(BOOL:RUN, REAL:X0, REAL:X1, TIME:TR, TIME:CYCLE, BOOL:HOLDBACK, REAL:ERROR, REAL:PV) => (BOOL:RAMP, REAL:XOUT)

When RUN and HOLDBACK are False, XOUT will follow X0 value. When RUN is True and HOLDBACK value is False, XOUT will change for $OUT_{(to-1)}$ + (X1 – $XOUT_{(to-1)}$) every CYCLE time value sampling period.

HYSTERESIS



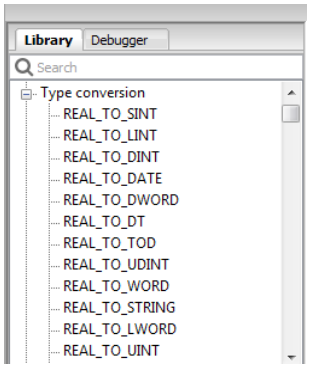
Hysteresis

The hysteresis function block provides a hysteresis boolean output driven by the difference of two floating point (REAL) inputs XIN1 and XIN2.

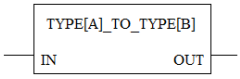
(REAL:XIN1, REAL:XIN2, REAL:EPS) => (BOOL:Q)

When XIN1 value will be grater than XIN2 + EPS value, Q becomes True. When XIN1 value will be less than XIN2 - EPS value, Q becomes False.

2.6.3 Type conversion



TYPE[A]_TO_TYPE[B]



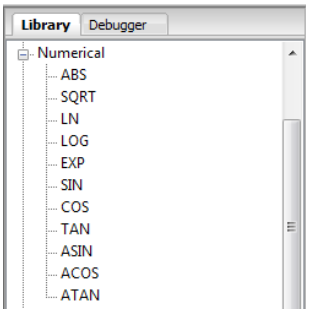
Data type conversion

(TYPE[A]:IN) => (TYPE[B]:OUT)

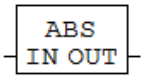
ST syntax example:

```
OUT := TYPE[A]_TO_TYPE[B](IN1);
```

2.6.4 Numerical



ABS

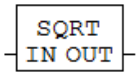


Absolute number

(ANY_NUM:IN) => (ANY_NUM:OUT)

ST syntax example: `OUT := ABS(IN1);`

SQRT

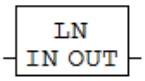


Square root (base 2)

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := SQRT(IN1);`

LN

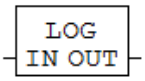


Natural logarithm

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := LN(IN1);`

LOG

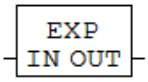


Logarithm to base 10

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := LOG(IN1);`

EXP

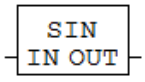


Exponentiation

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := EXP(IN1);`

SIN

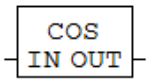


Sine

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := SIN(IN1);`

COS

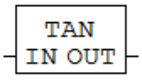


Cosine

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := COS(IN1);`

TAN

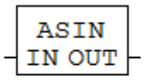


Tangent

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := TAN(IN1);`

ASIN

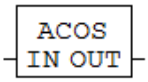


Arc sine

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := ASIN(IN1);`

ACOS

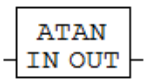


Arc cosine

(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := ACOS(IN1);`

ATAN

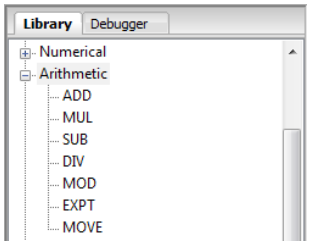


Arc tangent

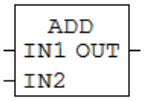
(ANY_REAL:IN) => (ANY_REAL:OUT)

ST syntax example: `OUT := ATAN(IN1);`

2.6.5 Arithmetic



ADD



Addition

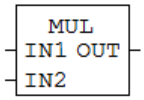
(ANY_NUM:IN1, ANY_NUM:IN2) => (ANY_NUM:OUT)

OUT = IN1 + IN2.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 + IN2;`

MUL



Multiplication

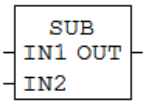
(ANY_NUM:IN1, ANY_NUM:IN2) => (ANY_NUM:OUT)

OUT = IN1 * IN2.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 * IN2;`

SUB



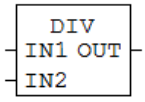
Subtraction

(ANY_NUM:IN1, ANY_NUM:IN2) => (ANY_NUM:OUT)

OUT = IN1 - IN2.

ST syntax example: `OUT := IN1 - IN2;`

DIV



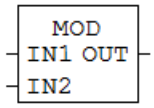
Division

(ANY_NUM:IN1, ANY_NUM:IN2) => (ANY_NUM:OUT)

OUT = IN1 / IN2.
For example 1234 / 10 = 3.

ST syntax example: `OUT := IN1 / IN2;`

MOD



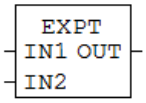
Remainder (modulo)

(ANY_NUM:IN1, ANY_NUM:IN2) => (ANY_NUM:OUT)

OUT = IN1 modulo IN2.
For example 1234 modulo 10 = 4.

ST syntax example: `OUT := IN1 MOD IN2;`

EXPT



Exponent

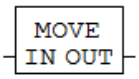
(ANY_REAL:IN1, ANY_NUM:IN2) => (ANY_REAL:OUT)

OUT = $IN1^{IN2}$.

For example $2^3 = 8$.

ST syntax example: `OUT := IN1 ** IN2;`

MOVE



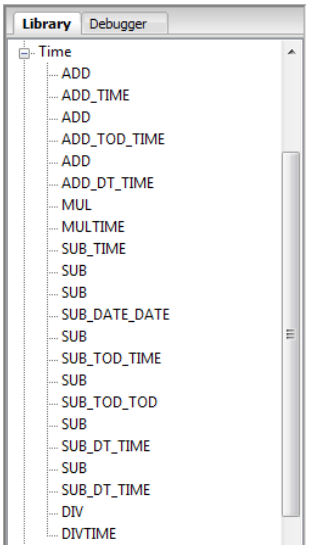
Assignment

(ANY:IN) => (ANY:OUT)

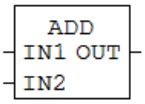
OUT = IN.

ST syntax example: `OUT := IN1;`

2.6.6 Time



ADD

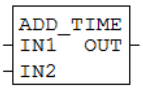


Time addition

(TIME:IN1, TIME:IN2) => (TIME:OUT)

Number of inputs can be expanded.

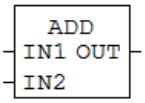
ADD_TIME



Time addition

(TIME:IN1, TIME:IN2) => (TIME:OUT)

ADD

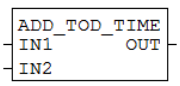


Time-of-day addition

(TOD:IN1, TIME:IN2) => (TOD:OUT)

Number of inputs can be expanded.

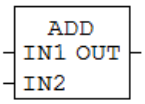
ADD_TOD_TIME



Time-of-day addition

(TOD:IN1, TIME:IN2) => (TOD:OUT)

ADD

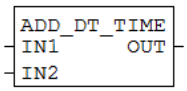


Addition

(ANY_NUM:IN1, ANY_NUM:IN2) => (ANY_NUM:OUT)

Number of inputs can be expanded.

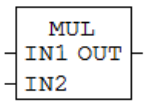
ADD_DT_TIME



Date addition

(DT:IN1, TIME:IN2) => (DT:OUT)

MUL

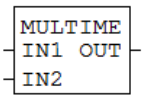


Multiplication

(ANY_NUM:IN1, ANY_NUM:IN2) => (ANY_NUM:OUT)

Number of inputs can be expanded.

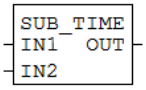
MULTIME



Time multiplication

(TIME:IN1, ANY_NUM:IN2) => (TIME:OUT)

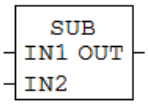
SUB_TIME



Time subtraction

(TIME:IN1, TIME:IN2) => (TIME:OUT)

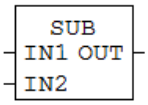
SUB



Time subtraction

(TIME:IN1, TIME:IN2) => (TIME:OUT)

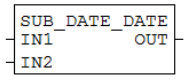
SUB



Date subtraction

(DATE:IN1, DATE:IN2) => (TIME:OUT)

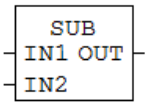
SUB_DATE_DATE



Date subtraction

(DATE:IN1, DATE:IN2) => (TIME:OUT)

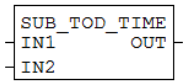
SUB



Time-of-day subtraction

(TOD:IN1, TIME:IN2) => (TOD:OUT)

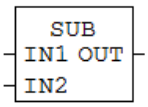
SUB_TOD_TIME



Time-of-day subtraction

(TOD:IN1, TIME:IN2) => (TOD:OUT)

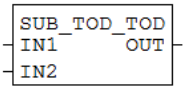
SUB



Time-of-day subtraction

(TOD:IN1, TOD:IN2) => (TIME:OUT)

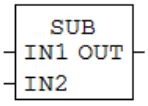
SUB_TOD_TOD



Time-of-day subtraction

(TOD:IN1, TOD:IN2) => (TIME:OUT)

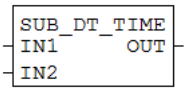
SUB



Date and time subtraction

(DT:IN1, TIME:IN2) => (DT:OUT)

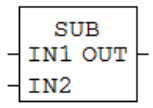
SUB_DT_TIME



Date and time subtraction

(DT:IN1, TIME:IN2) => (DT:OUT)

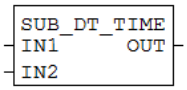
SUB



Date and time subtraction

(DT:IN1, DT:IN2) => (TIME:OUT)

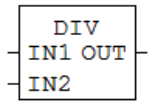
SUB_DT_TIME



Date and time subtraction

(DT:IN1, DT:IN2) => (TIME:OUT)

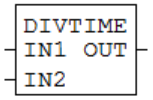
DIV



Time division

(TIME:IN1, ANY_NUM:IN2) => (TIME:OUT)

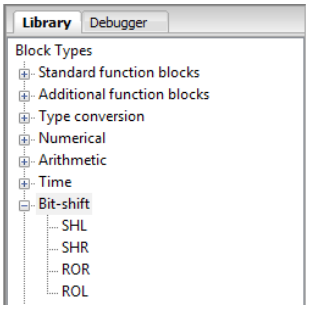
DIVTIME



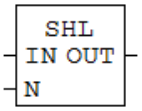
Time division

(TIME:IN1, ANY_NUM:IN2) => (TIME:OUT)

2.6.7 Bit-shift



SHL



Shift left

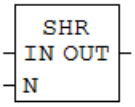
(ANY_BIT:IN, ANY_INT:N) => (ANY_BIT:OUT)

OUT represents IN variable shifted left by N bits. Zeros are filled on the right side of the OUT variable.

ST syntax example:

```
OUT := SHL(IN := IN1, N := IN2);
```

SHR



Shift right

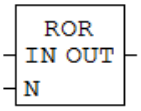
(ANY_BIT:IN, ANY_INT:N) => (ANY_BIT:OUT)

OUT represents IN variable shifted right by N bits. Zeros are filled on the left side of the OUT variable.

ST syntax example:

```
OUT := SHR(IN := IN1, N := IN2);
```

ROR



Rotate right

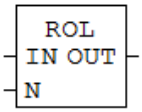
(ANY_NBIT:IN, ANY_INT:N) => (ANY_NBIT:OUT)

OUT represents IN variable right rotated by N bits. Each rotation most right bit is filled into most left bit of the OUT variable.

ST syntax example:

```
OUT := ROR(IN := IN1, N := IN2);
```

ROL



Rotate left

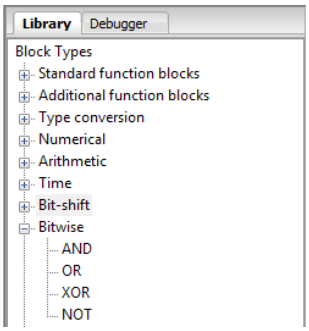
(ANY_NBIT:IN, ANY_INT:N) => (ANY_NBIT:OUT)

OUT represents IN variable left rotated by N bits. Each rotation most left bit is filled into most right bit of the OUT variable.

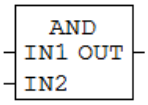
ST syntax example:

```
OUT := ROL(IN := IN1, N := IN2);
```

2.6.8 Bitwise



AND



Bitwise AND

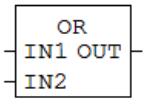
(ANY_BIT:IN1, ANY_BIT:IN2) => (ANY_BIT:OUT)

OUT = IN1 *AND* IN2.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 AND IN2;`

OR



Bitwise OR

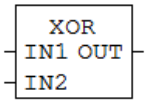
(ANY_BIT:IN1, ANY_BIT:IN2) => (ANY_BIT:OUT)

OUT = IN1 *OR* IN2.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 OR IN2;`

XOR



Bitwise XOR

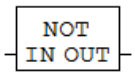
(ANY_BIT:IN1, ANY_BIT:IN2) => (ANY_BIT:OUT)

OUT = IN1 *EXCLUSIVE OR* IN2.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 XOR IN2;`

NOT



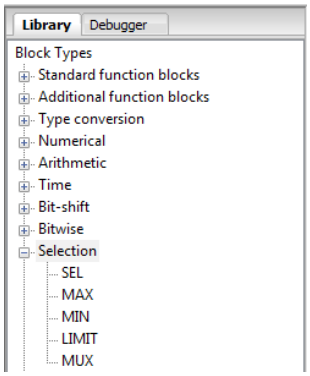
Bitwise inverting

(ANY_BIT:IN) => (ANY_BIT:OUT)

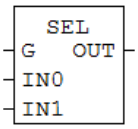
OUT = *NOT* IN.

ST syntax example: `OUT := IN1 NOT IN2;`

2.6.9 Selection



SEL

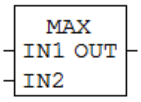


Binary selection (1 of 2)

(BOOL:G, ANY:IN0, ANY:IN1) => (ANY:OUT)

If G is False, OUT will follow IN0 value. If G is True, OUT will follow IN1 value.

MAX



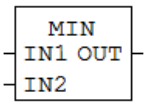
Maximum

(ANY:IN1, ANY:IN2) => (ANY:OUT)

This function block compares the magnitude of the values present at input IN1 and IN2 reporting on its output the largest value (maximum value).

Number of inputs can be expanded.

MIN



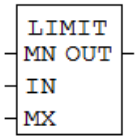
Minimum

(ANY:IN1, ANY:IN2) => (ANY:OUT)

This function block compares the magnitude of the values present at input IN1 and IN2 reporting on its output the smallest value (minimum value).

Number of inputs can be expanded.

LIMIT

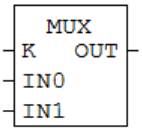


Limitation

(ANY:MN, ANY:IN, ANY:MX) => (ANY:OUT)

OUT will follow IN value between minimum MN and maximum MX value. If IN will be less than minimum MN value, OUT will represent MN value and if IN will be grater than maximum MX value, OUT will represent MX value.

MUX



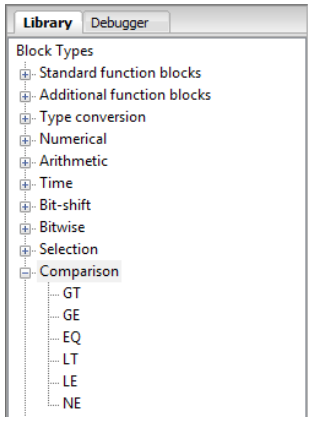
Multiplexer (select 1 of N)

(ANY_INT:K, ANY:IN0, ANY:IN1) => (ANY:OUT)

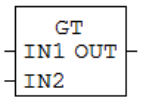
Depends on K value, one of IN1, IN2 .. INn is selected and OUT will represent the selected input value.

Number of inputs can be expanded.

2.6.10 Comparison



GT



Greater than

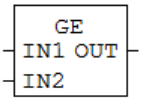
(ANY:IN1, ANY:IN2) => (BOOL:OUT)

OUT will become True if IN1 is greater than IN2, else OUT will be False.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 > IN2;`

GE



Greater than or equal to

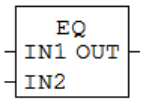
(ANY:IN1, ANY:IN2) => (BOOL:OUT)

OUT will become True if IN1 is greater or equal than IN2, else OUT will be False.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 >= IN2;`

EQ



Equal to

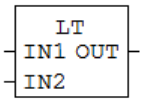
(ANY:IN1, ANY:IN2) => (BOOL:OUT)

OUT will become True if IN1 and IN2 are equal, else OUT will be False.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 = IN2;`

LT



Less than

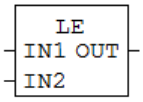
(ANY:IN1, ANY:IN2) => (BOOL:OUT)

OUT will become True if IN1 is less than IN2, else OUT will be False.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 < IN2;`

LE



Less than or equal to

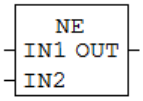
(ANY:IN1, ANY:IN2) => (BOOL:OUT)

OUT will become True if IN1 is less or equal than IN2, else OUT will be False.

Number of inputs can be expanded.

ST syntax example: `OUT := IN1 <= IN2;`

NE



Not equal to

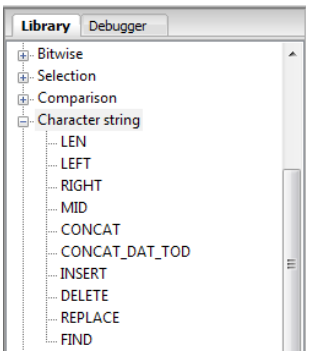
(ANY:IN1, ANY:IN2) => (BOOL:OUT)

OUT will become True if IN1 and IN2 are NOT equal, else OUT will be False.

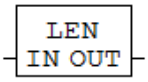
Number of inputs can be expanded.

ST syntax example: `OUT := IN1 <> IN2;`

2.6.11 Character string



LEN

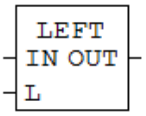


Length of string

(STRING:IN) => (INT:OUT)

OUT represents number of characters in IN string. For example IN string is 'ABCDEFGH', OUT will be 8.

LEFT

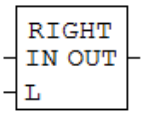


String left of

(STRING:IN, ANY_INT:L) => (STRING:OUT)

OUT represents string of L number of characters, leftmost of IN string. For example IN string is 'ABCDEFGH', L is 3, OUT string will be 'ABC'.

RIGHT

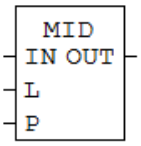


String right of

(STRING:IN, ANY_INT:L) => (STRING:OUT)

OUT represents string of L number of characters, rightmost of IN string. For example IN string is 'ABCDEFGH', L is 3, OUT string will be 'FGH'.

MID

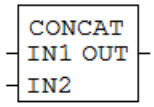


String from the middle

(STRING:IN, ANY_INT:L, ANY_INT:P) => (STRING:OUT)

OUT represents string of L characters of string IN, beginning at position P from left side of IN string. For example IN string is 'ABCDEFGH', L is 4 and P is 2. OUT string will be 'DE'.

CONCAT



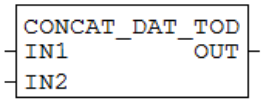
Concatenation

(STRING:IN1, STRING:IN2) => (STRING:OUT)

OUT represents concatenated string of IN1 and IN2. For example IN1 string is 'ABCD' and IN2 string is 'EFG', OUT string will be 'ABCDEFG'.

Number of inputs can be expanded.

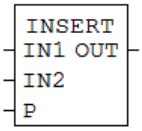
CONCAT_DAT_TOD



Time concatenation

(DATE:IN1, TOD:IN2) => (DT:OUT)

INSERT

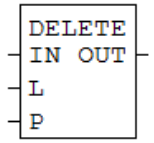


Insertion (into)

(STRING:IN1, STRING:IN2, ANY_INT:P) => (STRING:OUT)

OUT represents inserted string of IN2 to the IN1 string, after P position from left side of string IN1. For example if P is 2, IN1 string is 'ABC' and IN2 string is '12', OUT string will be 'AB12C'.

DELETE

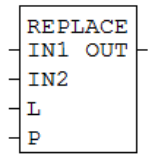


Deletion (within)

(STRING:IN, ANY_INT:L, ANY_INT:P) => (STRING:OUT)

OUT represents deleted string for number of L characters, beginning at IN string P position from left side of string IN1. For example L is 3, P is 2 and IN2 string is 'ABCDEFG, OUT string will be 'AEFG'.

REPLACE

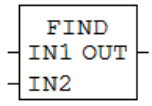


Replacement (within)

(STRING:IN1, STRING:IN2, ANY_INT:L, ANY_INT:P) =>
(STRING:OUT)

OUT represents replaced string for number of L characters, beginning at P position from left side of string IN1. For example L is 3, P is 2 and IN2 string is 'ABCDEFG, OUT string will be 'AEFG'.

FIND

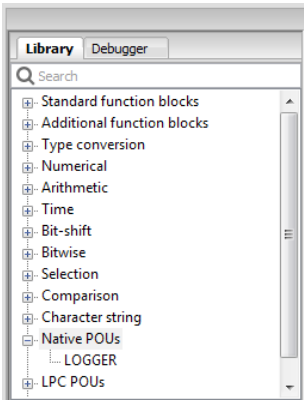


Find position

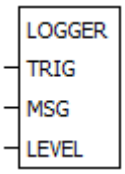
(STRING:IN1, STRING:IN2) => (INT:OUT)

OUT represents first left position in string IN1 where string IN2 starts. If string IN2 is not found in string IN1, OUT will be 0. For example string IN1 is 'ABCDEFG', string IN2 is 'DEF', OUT will be 4.

2.6.12 Native POUs



LOGGER

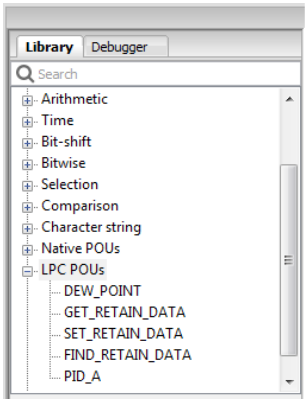


Logger

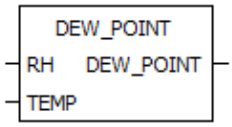
(BOOL:TRIG, STRING:MSG, LOGLEVEL:LEVEL) => ()

Logger is used for off-line logging. Log data defined by trig, message and log level are saved in MCU database. Log data can be read from PLC Log (2.10 PLC Log). Level must be a number between 0 and 3 written as Expression.

2.6.13 LPC POUs



DEW_POINT

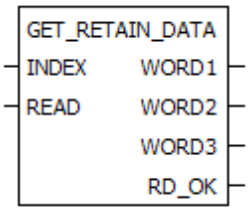


Dew-point

(REAL:RH, REAL:TEMP) => (REAL:DEW_POINT)

Calculate dew-point from temperature and humidity.

GET_RETAIN_DATA



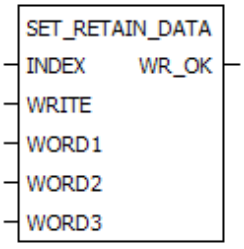
Get retain data

(UINT:INDEX, BOOL:READ) => (UINT:WORD1, UINT:WORD2, UINT:WORD3, BOOL:RD_OK)

Get three variables (*WORD1*, *WORD2* and *WORD3*) from fixed location (*INDEX*) inside retain database when *READ* is on. *INDEX* can be from 0 to 1999.

Primary used for RFID key card data.

SET_RETAIN_DATA



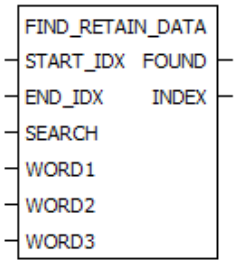
Set retain data

(UINT:INDEX, BOOL:WRITE, UINT:WORD1, UINT:WORD2, UINT:WORD3) => (BOOL:WR_OK)

Set three variables (*WORD1*, *WORD2* and *WORD3*) to fixed location (*INDEX*) inside retain database when *WRITE* is on. *INDEX* can be from 0 to 1999.

Primary used for RFID key card data.

FIND_RETAIN_DATA



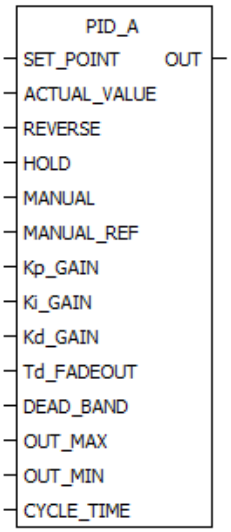
Find retain data

(UINT:START_IDX, UINT:END_IDX, BOOL:SEARCH, UINT:WORD1, UINT:WORD2, UINT:WORD3) => (BOOL:FOUND, UINT:INDEX)

Search if three variables (WORD1, WORD2 and WORD3) are currently inside of retain database. Search can be narrowed between START_IDX and END_IDX.

Primary used for RFID key card data.

PID_A



PID A version

(REAL:SET_POINT, REAL:ACTUAL_VALUE, BOOL:REVERSE, BOOL:HOLD, BOOL:MANUAL, REAL:MANUAL_REF, REAL:Kp_GAIN, REAL:Ki_GAIN, REAL:Kd_GAIN, TIME:Td_FADEOUT, REAL:DEAD_BAND, REAL:OUT_MAX, REAL:OUT_MIN, TIME:CYCLE_TIME) => (REAL:OUT)

PID A version contains most used parameters for automation PID process control usage. Kp, Ki and Kd are independent.

SET_POINT – set-point value

ACTUAL_VALUE – actual value

REVERSE – reverse (forward) mode calculation setting

HOLD – hold mode

MANUAL – manual mode

MANUAL_REF – OUT reference at manual mode

Kp_GAIN – proportional gain parameter

Ki_GAIN – Integral gain parameter

Kd_GAIN – Derivative gain parameter

Td_FADEOUT – fadeout time of Kd_GAIN output influences

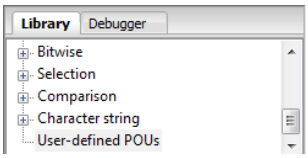
DEAD_BAND – dead band

OUT_MAX - output limitation (maximum)

OUT_MIN - output limitation (minimum)

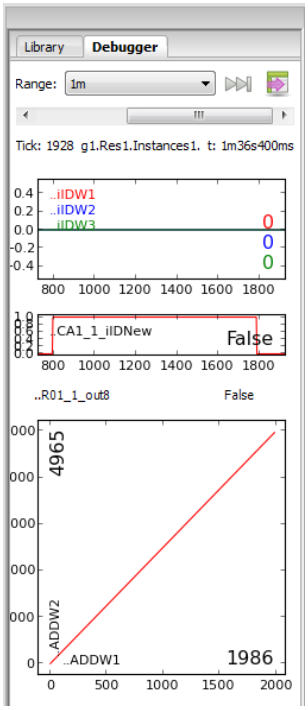
CYCLE_TIME – calculation cycle time

2.6.14 User-defined POUs



User-defined POUs -All user-defined functions and function blocks are added in this library group.

2.7 Debugger



Debugger can display actual-online values of selected variables in numerical and graphical presentation. Variables to be displayed can be added here by clicking on its glasses icon in Project tab (instances window) or double-click on variable in editor workspace.
Actual values of the Variables can be presented as:
- numerical value display,
- one dimension graph with one or more variables (drag-and-drop variable to the right side of existing graph) and
- multi dimensional graph (drag-and-drop variable to the left side of existing graph).

Values-trends are displayed inside the selectable time range (10ms,..,1s,..1m,..,1h,.., 24h). The range is common for all observed variables.

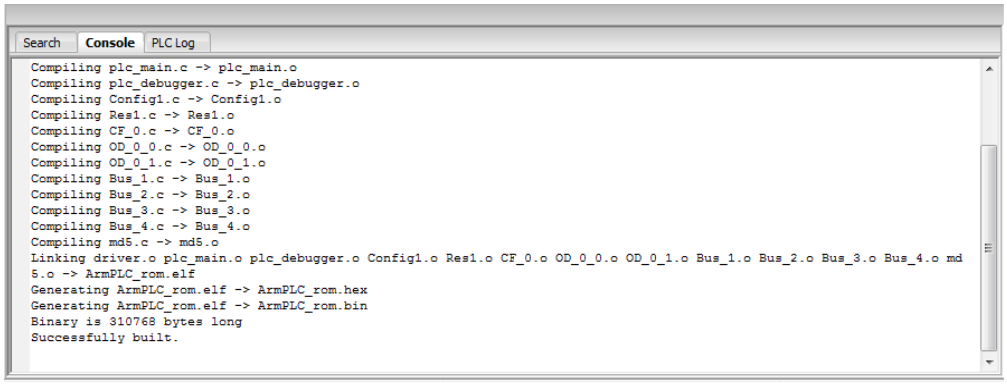
Variables can also be exported to the clipboard.

Forcing (releasing) of these variables is also possible inside this window by clicking on padlock icon (move mouse pointer over the value and click on the padlock locked).

2.8 Search

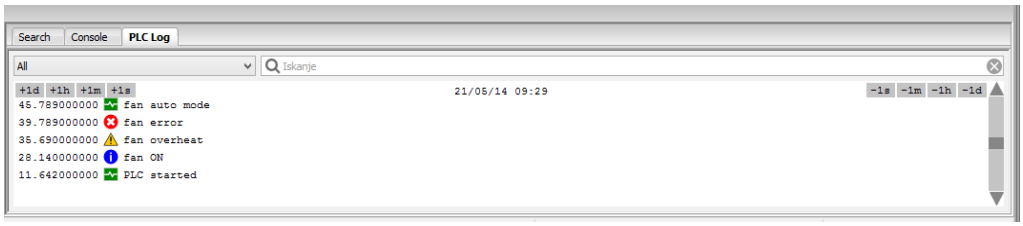
Search -Search window shows the result(s) of the Search in Project request from the Edit toolbar. Custom search pattern and different scope can be selected.

2.9 Console



Console -Contains log of *LPC Manager* activities during processing system program activities (build, transfer, debugging, communication,...)

2.10 PLC Log



PLC Log -Contains log data logged by logger function which are stored on MCU. Log data are filtered by level type. Level type are indicate by signs (error sign = level 0, warning sign = level 1, information sign = level 2 and status sign = level 3).

3 PROGRAMMING LANGUAGES

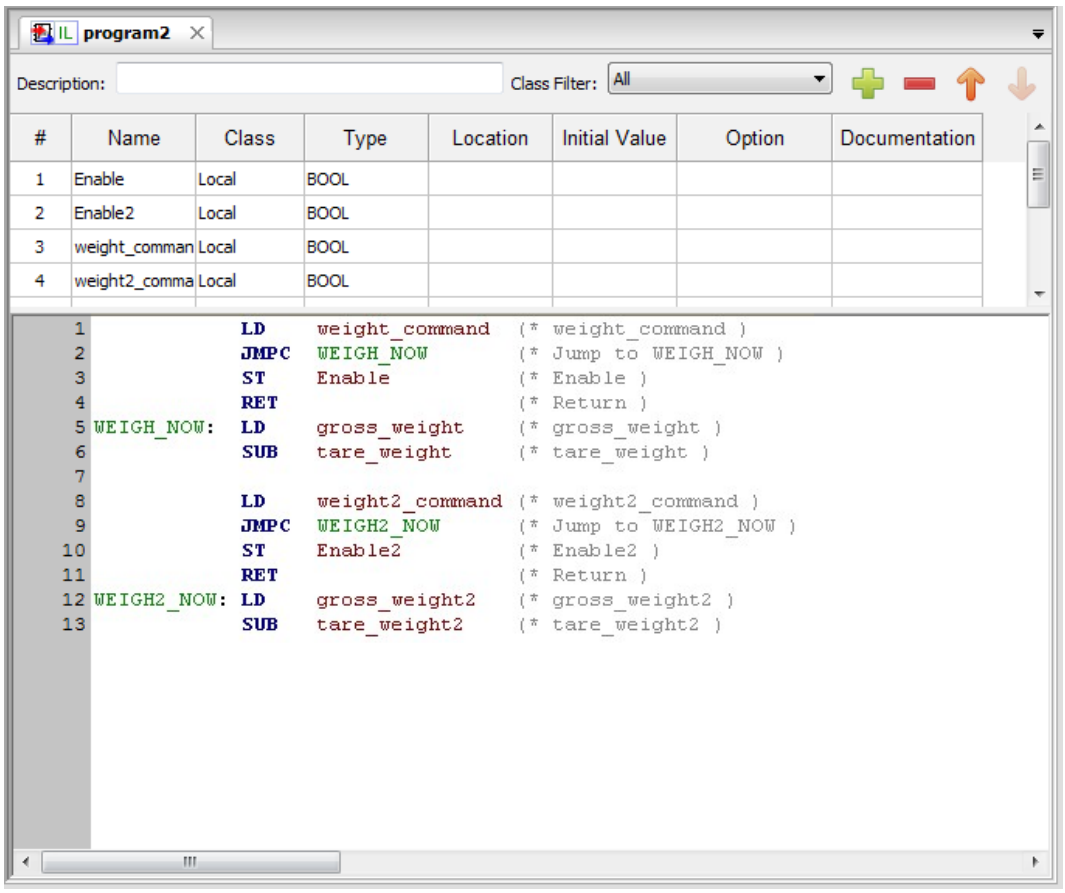
LPC Manager is based on *PLC (programmable logic controller)* programming languages *International Standard IEC 61131-3*.

Following types of PLC programming languages can be used:

- Textual:
  - IL Instruction List
  - ST Structured Text
- Graphic:
  - FBD Function Block Diagram
  - LD Ladder Diagram
  - SFC Sequential Function Chart

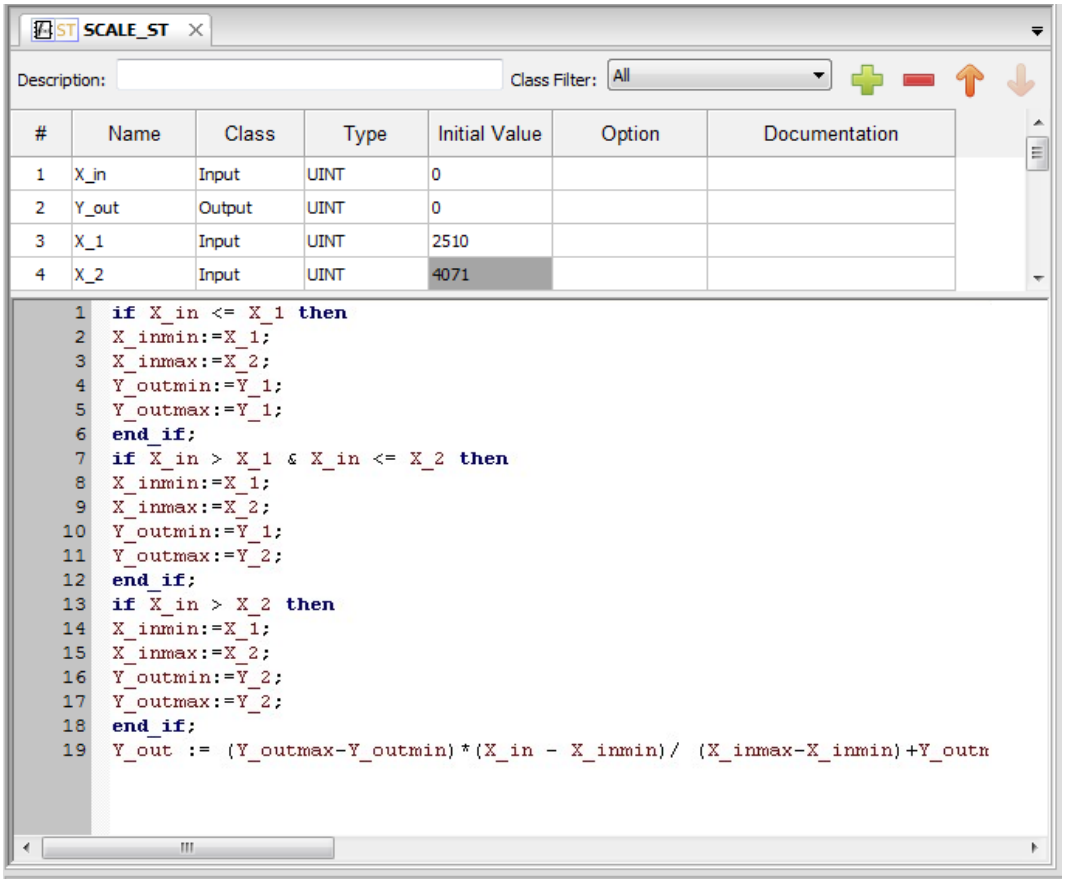
3.1 IL - Instruction List

Instruction list programmable language is composed of a sequence of instructions. It is similar as assembler language. Each instruction shall begin on a new line and shall contain an operator with optional modifiers and, if necessary for the particular operation, one or more operands separated by commas. Operands can be literals, enumerated values and variables.



3.2 ST - Structured Text

Structured text programmable language is composed of a sequence of instructions. It is higher level language similar as C. End of a textual line shall be treated the same as a space (SP) character.



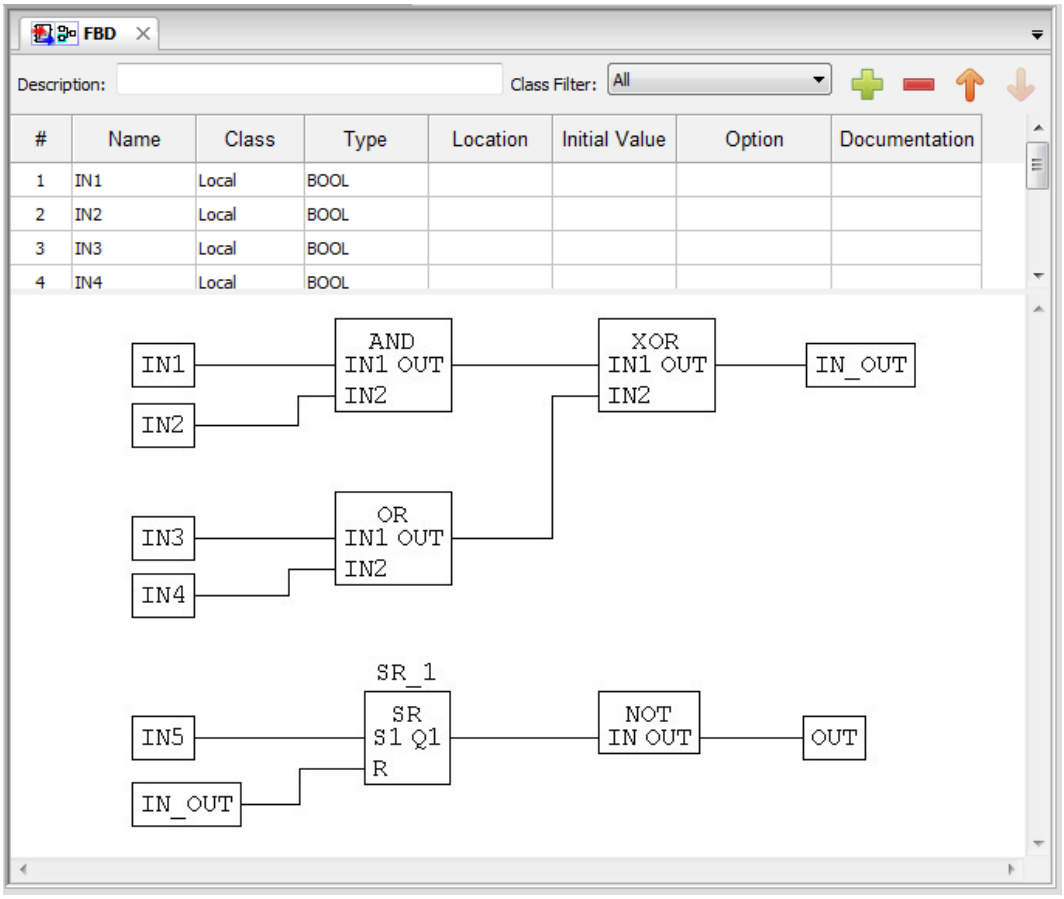
Structured text syntax examples:

```
(*************************************************************)
(*                    RETURN                                 *)
(*************************************************************)
RETURN;

(*************************************************************)
(*                    IF                                     *)
(*************************************************************)
IF Temperature < 10 THEN fan := 0;
ELSIF damperOPEN = TRUE THEN
  fan := 10000;
  start := TRUE;
ELSE
  fan := 0;
  start := FALSE;
  damper := TRUE;
END_IF ;

(*************************************************************)
(*                    CASE                                   *)
(*************************************************************)
CASE keypad OF
  1,5:  DISPLAY := Temperature;
  2:  DISPLAY := fan_speed;
  3:  DISPLAY := setpoint;
  4,6..9: DISPLAY := Rh;
ELSE  DISPLAY := DISPLAY;
END_CASE;

(*************************************************************)
(*                    FOR                                    *)
(*************************************************************)
FOR I := 0 TO 10 BY 1 DO
  Keycard0[I] := Keycard[I];
END_FOR;

(*************************************************************)
(*                    WHILE                                  *)
(*************************************************************)
WHILE temperature < 2000 and not door DO
  fan := 10000;
END_WHILE;

(*************************************************************)
(*                    REPEAT                                 *)
(*************************************************************)
REPEAT
  fan := 5000;
UNTIL temperature < 2300 and not door
END_REPEAT;

(*************************************************************)
(*                    EXIT                                   *)
(*************************************************************)
FOR I := 0 TO 10 BY 1 DO
  IF NewKeycard = Keycard[I] THEN
    door := TRUE;
    EXIT;
  END_IF;
END_FOR;
```

3.3 FBD - Function Block Diagram

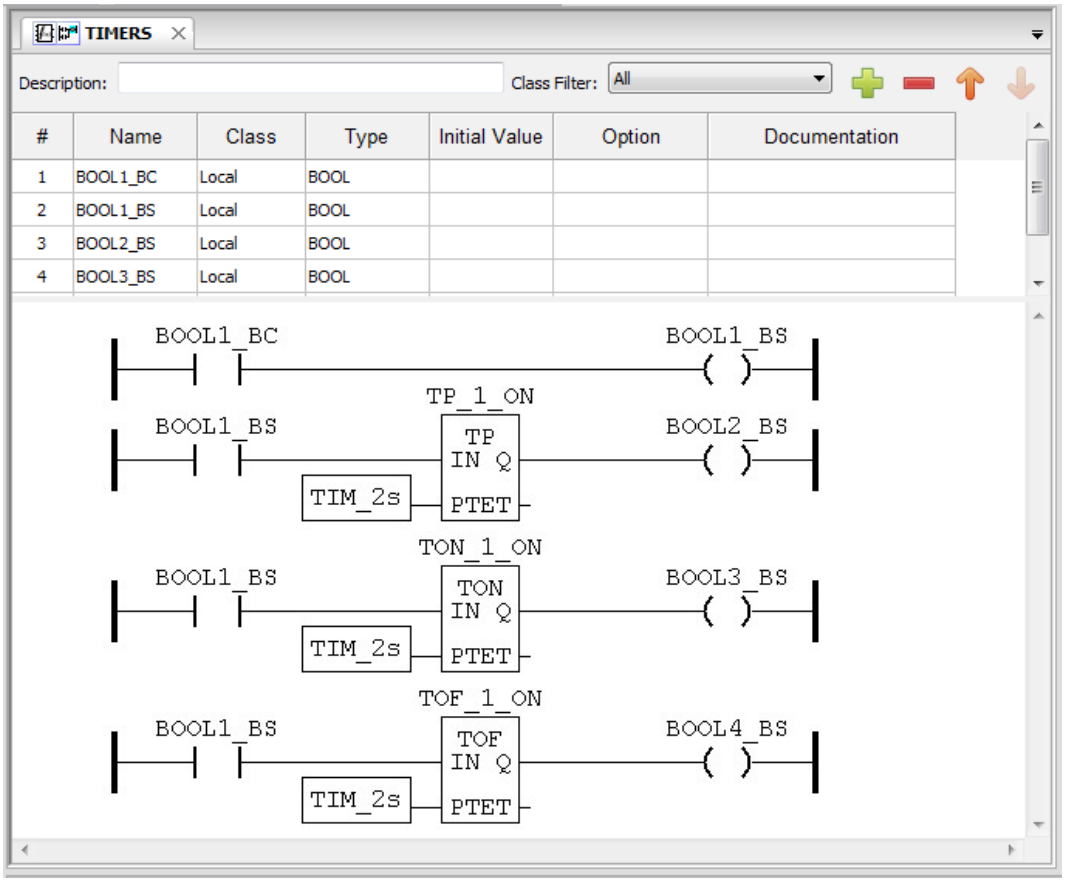
Function block diagram programmable language is a graphical language for the programming of programmable controllers.

Elements of the FBD language shall be interconnected by signal flow lines. Outputs of function blocks shall not be connected together. In particular, the "wired-OR" construct of the LD language is not allowed in the FBD language. An explicit Boolean "OR" block is required instead.



3.4 LD - Ladder Diagram

Ladder diagram programmable language is a graphical language for the programming of programmable controllers. It enables the programmable controller to test and modify data by means of standardized graphic symbols. These symbols are laid out in networks in a manner similar to a "rung" of a relay ladder logic diagram. LD networks are bounded on the left and right by power rails.

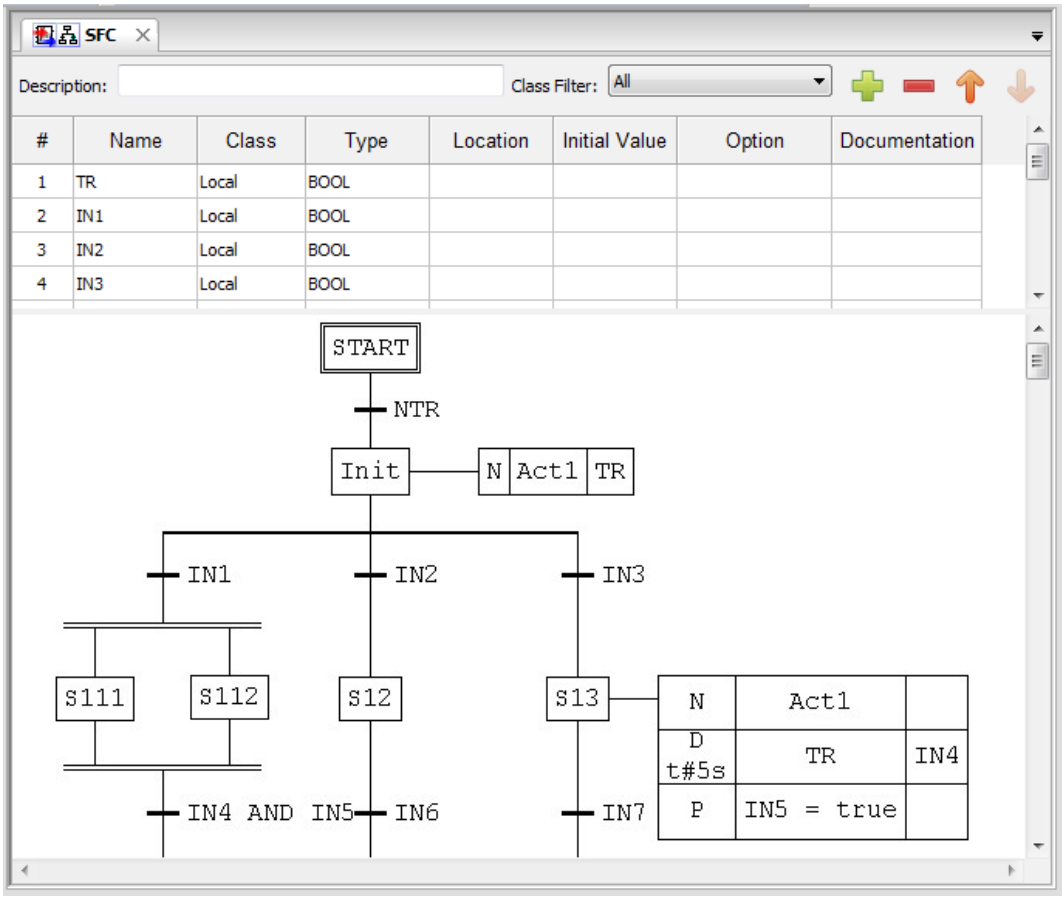


3.5 SFC - Sequential Function Chart

Sequential function chart programmable language is a graphical language for the programming of programmable controllers. Sequential function chart elements are used to structure the internal organization of a programmable controller program organization unit, written in one of the *PLC* (programming logic controller) programming languages explained in this document, for the purpose of performing sequential control functions.

The SFC elements provide a means of partitioning a programmable controller program organization unit into a set of steps and transitions interconnected by directed links. Associated with each step is a set of actions, and with each transition a transition condition.

Since SFC elements require storage of state information, the only program organization units which can be structured using these elements are *function blocks* and *programs*. If any part of a program organization unit is partitioned into SFC elements, the entire program organization unit shall be so partitioned. If no SFC partitioning is given for a program organization unit, the entire program organization unit shall be considered to be a single action which executes under the control of the invoking entity.



APPENDIX A - ERROR REPORTING

If you think you found a bug in our software or you have an idea of what can be improved or added, you are most welcome to share your thoughts with us (*support@smarteh.si*). We will consider the possibilities and try to include them in our next release.

You should contact your vendor with the description. The following information should be included:

- Software version.
- Detailed description of the bug or idea.
- If possible, steps that will recreate the problem (if bug is being reported).
- Your contact information (e-mail, phone, fax).

In case we need more information we may need to contact you before we can determine the exact solution. And remember: the only software without a need for maintenance is the software not being used!

APPENDIX B – DOCUMENT HISTORY

The following table describes all the changes to the document.

Date	V.	Description
30.09.2011	-	The preliminary version, issues as *LPC Manager User Manual*.
30.01.2012	001	First release.
30.06.2012	002	Changes from previous version.
25.05.2014	003	Change according new release of LPC Composer 5.0.1.32
22.01.2016	004	Change according new release of LPC Smarteh IDE 5.1.4.2