General contents

SoMachine Basic software
Programming software for Modicon M221 and M221 Book logic controllers

Compatibility of offers

SoMachine Basic programming software

> Modicon M221 logic controllers
> Modicon M221 Book logic controllers
> Modicon TM3 expansion modules
> Modicon TM2 expansion modules

SoMachine Basic software

Presentation

SoMachine Basic programming software is a user-friendly tool designed to develop projects on Modicon M221 or Modicon M221 Book logic controllers. It can convert applications created on TwidoSuite and TwidoSoft.

■ SoMachine Basic is organized according to the project development cycle: navigation of the software is easy and intuitive.
■ SoMachine Basic offers a modern interface, so that getting started is:
□ User-friendly and fast: the simplified interface helps you find the information you need in two or three clicks maximum
□ Efficient, due to the functions available
■ SoMachine Basic creates an operator interface for remote graphic display unit **TMH2GDB**.

Connecting a PC to the controller

There are several ways of connecting a PC to Modicon M221 logic controllers during the programming, debugging, and maintenance phases.

■ Link via connection cables

The PC is connected to the M221 controller via the USB-B port, using cable **TCSXCNAMUM3P** (mini-USB to USB).

■ Link via modem or router

Modems can reduce the frequency of on-site visits for certain maintenance operations.
□ The modem connected to the M221 logic controller must be declared in the hardware configuration. It will be initialized by the controller automatically (Hayes initialization string).
□ At the PC end, the SoMachine Basic software will associate a special modem connection that will be memorized in the project (including the phone number to use).

■ Ethernet network link

With their embedded Ethernet port TM221●●**E**●● logic controllers can be connected to a PC using the Ethernet network and the Modbus TCP/IP protocol.

■ Bluetooth® wireless link

The Bluetooth® wireless link enables complete freedom of movement within a 10 m/ *33 ft* radius around the controller.
Schneider Electric offers Bluetooth® wireless adapters both for the controller side and the PC side. Please consult our website: www.schneider-electric.com.

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Properties
Configuration
Programming
Graphic display
Commissioning

Selection tree | Editor area | Product reference catalog

Properties
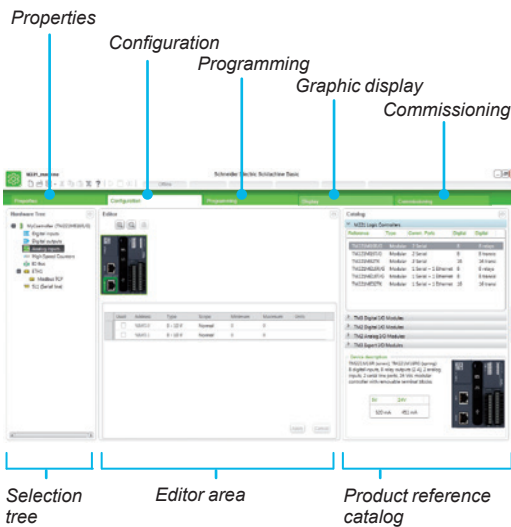
Configuration

Functions

Navigation

SoMachine Basic offers intuitive and visual navigation.

□ The presentation is optimized for selecting the development cycle stage of the project (Properties, Configuration, Programming, Display, Commissioning).

□ Each screen is divided into 3 zones:
- A selection tree
- An editor area: a streamlined workspace to carry out what is necessary and relevant to the current task, without any superfluous information
- A product reference catalog organized by range

Project management

The project management function is used to:

□ Create a new project

□ Open a project from the PC (hard disk, CD-ROM, USB flash drive, etc.)

□ Retrieve a project from an M221 logic controller

□ Open a Twido project, with automatic conversion

□ Create a new project based on an existing project template

□ Print a project

Properties

Screens enabling entry of identification data for a new project, such as:

□ Details of the project creator

□ Details of their company

□ Information relating to the project

□ Project protection information

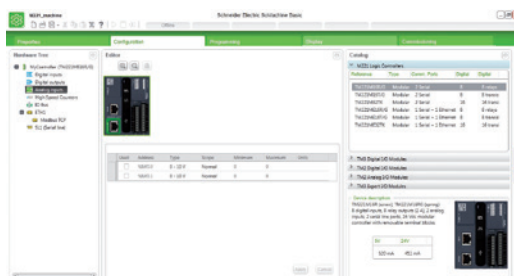□ Application protection information
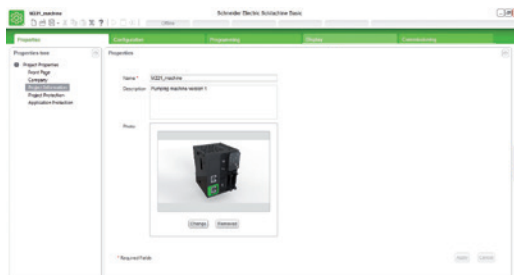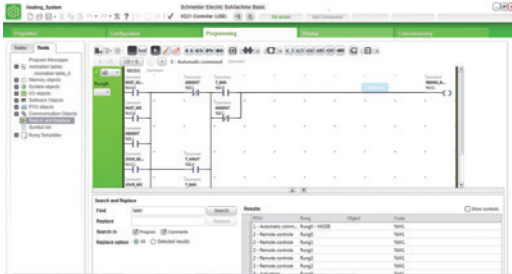
Configuration

Configuration allows:

■ Creation of the hardware configuration corresponding to the application by selecting the following from a "catalog":

□ The logic controller (Modicon M221)

□ The I/O expansion modules (Modicon TM2, Modicon TM3)

□ The standard and application cartridges

A graphic editor enables easy assembly of the various elements using simple drag & drop.

■ Configuration of all the hardware functions selected for the application:

□ Discrete, analog I/O

□ High speed counter (HSC) inputs

□ High speed outputs:
- Pulse width modulation (PWM)
- Pulse generator (PLS)
- Pulse train output (PTO)
- Frequency generator

□ Communication ports (Ethernet, serial links):
- Ethernet: EtherNet/IP, Modbus TCP client and server, Exchange table
- Serial links: Modbus RTU or ASCII, ASCII protocol, Display
- The Modbus Serial IOScanner and Modbus TCP IOScanner protocols are used to automatically configure an Altivar variable speed drive, other Schneider device, or a generic device.

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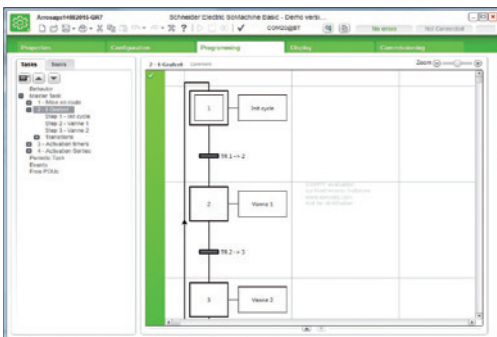
Programming

Grafcet graphic language

Display

Functions

Programming

- The program is organized in POUs (program organization units) or sections. These sections consist of rungs (networks) to simplify both reading and navigation within the program.
- ☐ The POUs are associated with various tasks of the application: master, periodic, events.
  They can be programmed in:
  - Instruction List (IL) language
  - Ladder (LD) language
  - Grafcet graphic language
  - Structured Text (ST) operations
  - User-defined functions
  - User-defined function blocks
- ☐ Rungs define all the connectable elements in the application.

Ladder editor

- The Ladder editor provides intuitive and high-performance programming:
- ☐ Drag & drop operation
- ☐ Undo/Redo function
- ☐ Choice of keyboard shortcuts and toolbar according to the user profile
- ☐ Easy connection of Ladder elements using the "Pencil" and "Rubber" tools
- ☐ Assistance with connection of Ladder elements when creating rungs
- ☐ Easy linking of variables to the Ladder elements
- ☐ Context-sensitive online help
- ☐ Instruction search and syntax wizard
- ☐ Project backup, even if the Ladder networks are not complete
- ☐ Automatic analysis and compilation
- Modification online and in Run mode (this mode allows the connected controller program to be modified)
- Animation tables
- Search and replace function with Trace function

Grafcet graphic language

Grafcet (Command Step-Transition Functional Graphic) is the French acronym for "**GRA**phe **F**onctionnel de **C**ommande **E**tape-**T**ransition".
Grafcet has been standardized under the classification index NF C 03-190. The corresponding European standard is EN 60848.

Grafcet language is based on a graphic representation that is easy to understand:
- Step: The step represents a partial system state, in which an action has been performed. The step can be active or inactive. The associated action is executed when the step is active, and remains dormant when the step is inactive.
- Transition: This links one or more previous steps to one or more subsequent steps. It describes a change of state.

Two conditions are monitored while moving to the next step:
- ☐ Each step preceding the transition must be active (and the actions must have been executed).
- ☐ The Boolean condition associated with the transition is "True".

Structured Text operations

Structured Text operations allow Structured Text applications to be easily converted:
- Conditional elements
- Loop elements
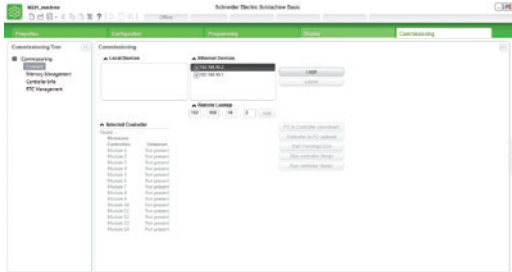- Complex calculation in an operation block

User-defined functions

A user-defined function allows you to create new functions with one or more input parameters, local variables, and a return value.

User-defined function blocks

A user-defined function block allows you to create new function blocks with one or more input and output parameters, local variables, and a return value.

Display

- Configuration of the remote graphic display
- Configuration of the Alarm list
- Creation and configuration of an operator interface from predefined pages (menu, monitor, control, bar graph, gage)

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Commissioning

High speed counting (HSC)

Fast counting (FC)

Altivar variable speed drives

Functions

Commissioning

Tasks that are available and can be carried out during application commissioning:
- Connection:
  □ Automatic discovery of the controller connected to the PC, according to the type of connection port: USB, Ethernet, Bluetooth®
  □ Transfer of application between PC and logic controller
- Firmware update of the logic controllers
- Comparison of the application on the controller with that on the PC
- Backup and restoration of all PLC data: memory area and SD card management
- Information about the PLC (logic controller)
- Real-time clock management

Counting

SoMachine Basic offers high speed counting software functions for Modicon M221 logic controllers (2 dual-phase counters or 4 single-phase counters).
- High speed counting (HSC)
The counter is accessed via the 32-bit function block %HSCi. It is programmed for execution of one of the following functions:
  □ Up/Down counter
  □ Bi-phase up/down counter
  □ Frequency meter
The pulses to be counted can come from an incremental encoder or proximity sensors (up/down counting) connected to inputs I0 and I1 of the M221 logic controller.
- Fast counting (FC)
The 16-bit %FCi fast counter enables up or down counting of pulses (rising edge) on the fast inputs of the M221 logic controller.

PTO

18 function blocks are used to manage the fast outputs (PTO) as outputs of the following type:
  □ Speed
  □ Position
  □ S-curve profile
  □ Execution of a points table (multi-segment)

The PTO function enables position control by pulse train - pulse/direction (P/D) or CW/CCW signals, depending on the type of servo drive.
These pulses are generated on outputs %Q0.0 and %Q0.1 of M221 logic controllers *(1)*.
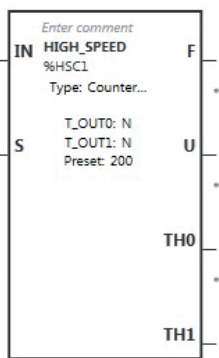
Altivar variable speed drives

There are 7 function blocks available for controlling the following on Altivar variable speed drives:
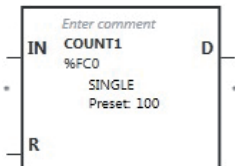 □ Power
  □ Speed
  □ Jog
  □ Status

Communication

There are 4 function blocks available to facilitate communication:
  □ Modbus serial link
  □ Modbus Ethernet link
  □ Exchanging messages over serial link
  □ Sending and receiving SMS messages

(1) On TM221C●40U logic controllers, up to 4 outputs support the function (PLS, PWM, frequency generator, or PTO).

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PLS function

PWM function

Functions
Position control

SoMachine Basic provides 3 positioning software functions for the Modicon M221 logic controllers used, for example, for stepper motor control.

■ PLS function

The PLS function block generates pulses of fixed ratio. In some cases, the frequency can be fixed and in others it is variable (as in control of slopes when driving a stepper motor). The %PLS function block can be programmed to generate a specific number of pulses.
The %PLS function blocks are assigned to the %Q0.0 or %Q0.1 outputs of M221 logic controllers *(1)*.
The pulse generator signal has a variable period, but with a constant duty cycle that establishes an ON to OFF ratio of 50% of the period.

■ PWM function

The PWM function block generates pulses of fixed frequency, with a variable ON to OFF ratio for the output signal. The ON to OFF duration ratio is a dynamic variable called %PWM.R, with a range from 1% to 100%.
The PWM function blocks are assigned to the %Q0.0 or %Q0.1 outputs of M221 logic controllers *(1)*.
The %PWM function block, defined by the user, generates a signal on output %Q0.0 or %Q0.1 of M221 logic controllers.

■ Frequency generator function (FREQGEN)

The frequency generator function generates a square wave signal on the outputs of M221 logic controllers *(1)* with a fixed duty cycle (50%).
The frequency can be configured from 0.1 Hz to 100 kHz with intervals of 0.1 Hz.

Event processing

Event management by the application.
■ Source types:
□ Events on embedded inputs
□ Threshold events on the high speed counter (HSC)
□ Periodic event (Timer)
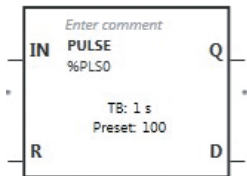■ Each event executes a single subroutine.

Process control (PID)
■ 14 PID programming loops
■ Auto-tuning algorithm
■ Analog/PWM output
■ Linear conversion of measurement input
■ 2 alarm levels (high and low) on the measurement
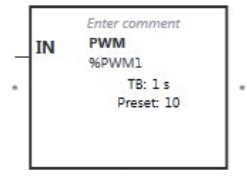■ Control output limits
■ Direct and reverse action

Data logging

A new function block with data logging assistant for configuration can be used to:
■ Create an historic data record
■ Create an events log
Save and restore a batch of memory words by:
■ Using %S and %SW (same logic as in flash memory)

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