Crouzet

Millenium 3 Tutorial

A brand of CST
CUSTOM SENSORS & TECHNOLOGIES

Tutorial
Millenium 3
Contents

TUTORIAL
Millenium 3

1 INTRODUCTION

Programming a Millenium 3 logic controller is simple and straightforward. This can be accomplished using either Ladder Logic (LD) or the more intuitive Function Block Diagrams(FBD).

LD language: Ladder language
Ladder Diagram (LD) language is a graphic language. It can be used to transcribe relay diagrams, and is suited for combinational programs.
You can use basic graphic symbols: contacts, coils, and blocks. Specific calculations can be executed within the operation blocks.
It has certain limitations: you can't use analog inputs and there is no option for arithmetic operations.

FBD language: Function Block Diagram
FBD mode allows graphic programming based on the use of predefined function blocks.
It offers a large range of basic functions: timer, counters, logic, etc.

These languages use:

- **Predefined function blocks:** Timers, Counters
- **Specific Functions:** Time Management, Data Conversion, Communication, etc.

For simple programs both programming options are available. For more complex applications FBD is the recommended option. This document will focus only on the FBD language.

Operating Modes
There are several operating modes for the programming workshop:

- **Edit mode:**
  The Edit mode is used to construct programs in FBD mode, which corresponds to the development of the application. In this mode you can: create macros, password protect your program, display dependencies between blocks, display a parameter summary table, preview function blocks by theme, or obtain online help for each function block.

- **Simulation mode:**
  When in Simulation mode the program is executed offline directly in the programming workshop (simulated on the PC). Each action on the chart (changing the state of an input, output forcing) updates the simulation windows. You can simulate a power failure or program timing, modify analog variables via the Millenium's virtual screen, or create a time-based jump event without changing the time on the PC.

- **Monitoring mode:**
  When in Monitoring mode the program is executed on the controller and the programming workshop is connected to the controller (PC ←→ controller connection). In this mode you can view machine operation in near real time on your PC, modify parameters via the front panel, or conduct progressive debugging and validate each part of the application.

In simulation and monitoring modes, it is possible to:

- View the output states and function block parameters of the program corresponding to the wiring sheet in the supervision window.
- Force the inputs/outputs to test program behavior under specific conditions.

2 PRODUCTS

Programming Cable

Memory Cartridge

3 GETTING STARTED WITH THE MILLENIUM 3

The MILLENIUM 3 is programmed using the **CLS M3** software workshop. It should therefore be connected to your PC. You can not create or modify a program from the Millenium front panel.

3.1 PC resources:

PC Pentium II 300 MHz (600 MHz recommended), 128 Mb of RAM memory (256 MB recommended). Compatible with Windows 2000, NT 4.0 SP5, XP, Vista and Windows 7.

3.2 Installing the software workshop.

If you have the M3 SOFT CD ROM (Part Number **88 970 111**) insert it into your PC and follow the instructions.

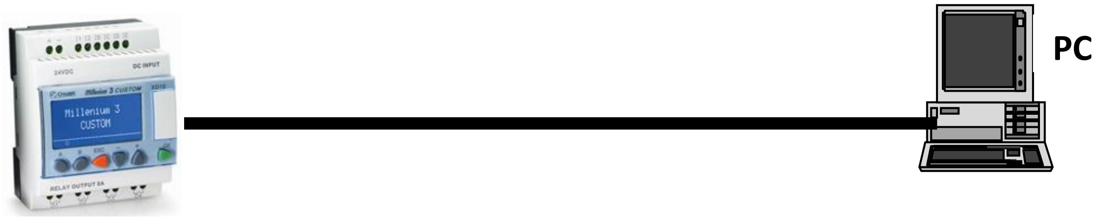
The programming software is also available for download from www.crouzet.com. Once downloaded extract the files and run the **Setup.exe** file. This will start the installation process.

Multiple installations are possible with the different available languages: English, French, German, Italian, and Spanish.

3.3 Connection to the PC

The connection with your PC can be made with any of the following options:

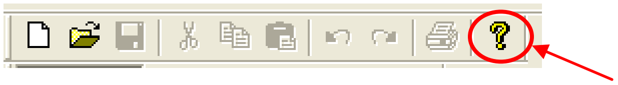
- Via the USB cable, P/N **88 970 109**.
- Via the Serial cable, P/N **88 970 102**
- Via the Bluetooth adapter, P/N **88 970 104**

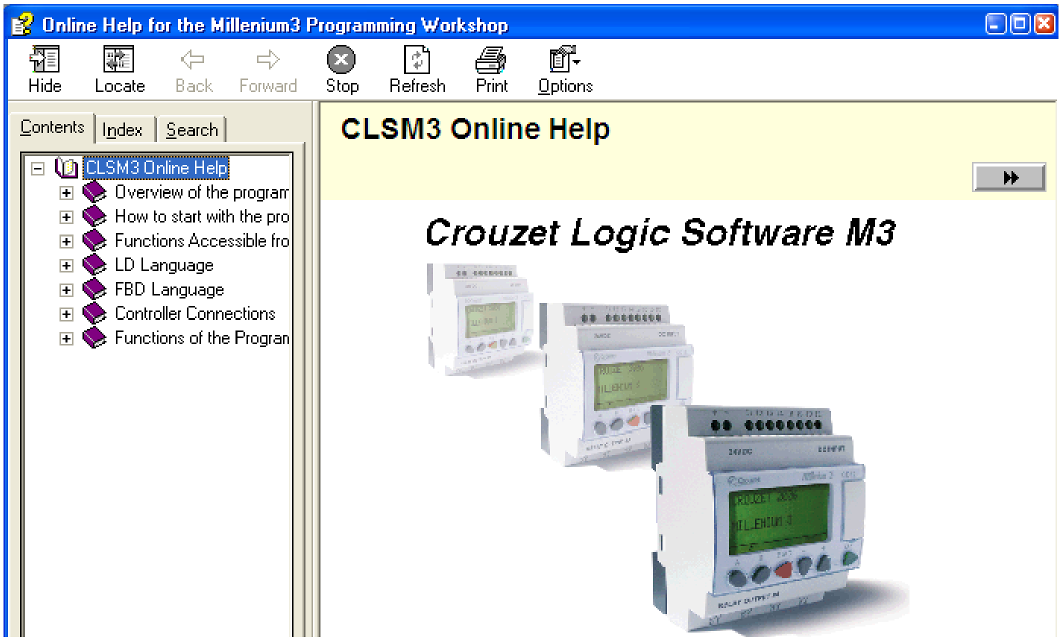


4 M3 SOFTWARE ENVIRONMENT

4.1 Accessing Help

The CLS 3 software workshop Help is accessible from the menu bar by clicking on **?** then Help, or by clicking on the **?** icon on the Standard Toolbar.





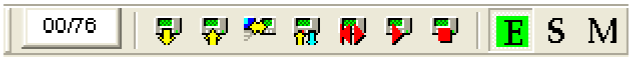
Help is also available for each function block. Just double click on the function block and then click on the **?** button.

4.2 Toolbars

The toolbars contain shortcuts to elements in the menu.

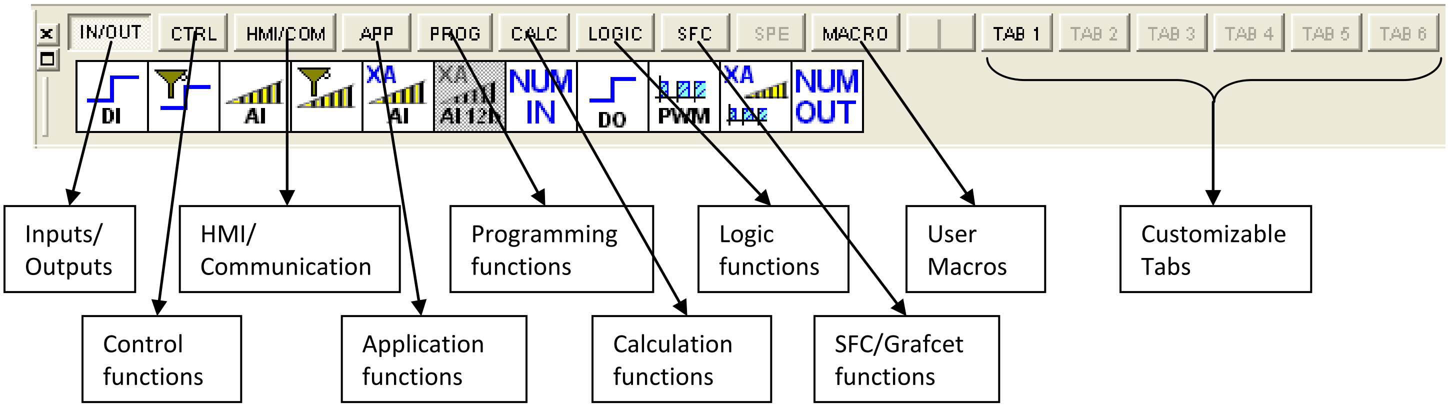
The Controller toolbar

This toolbar is used to manage actions on the Millenium and also to select the application mode (Editing, Supervision, Monitoring). Passing the cursor over the button icon displays the action associated with the button.



The function toolbar

The function bar contains all the Millenium functions.



Inputs/ Outputs

HMI/ Communication

Programming functions

Logic functions

User Macros

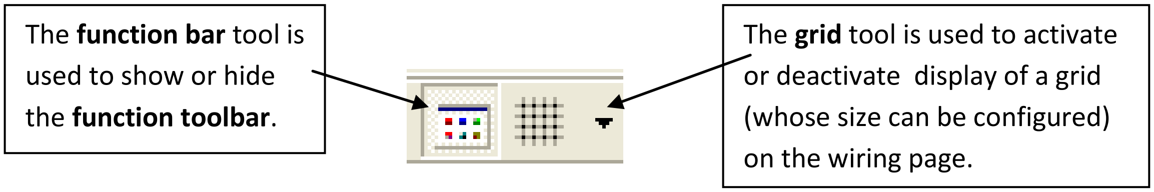
Customizable Tabs

Control functions

Application functions

Calculation functions

SFC/Grafcet functions



The **function bar** tool is used to show or hide the **function toolbar**.

The **grid** tool is used to activate or deactivate display of a grid (whose size can be configured) on the wiring page.

5 FUNCTIONS

Note: The following descriptions are illustrated in some cases with working examples. Double-click on the file icon to open the application, then select Simulation mode.

5.1 Inputs/Outputs:

DI **DI (Discrete Input)**: On/Off input.

The type of Discrete input can be selected from the Parameters window. This is displayed in the edit and supervision windows. These include: Discrete input, Contact, Limit switch, Proximity sensor, Presence sensor, Illuminated pushbutton, Selector switch, Pushbutton, and Normally open relay.

DI.pm3

See Help: double-click on the block and click on **?**.

AI **AI (Analog Input)**: Analog inputs are only available on DC powered controllers. This type of input can accept an input voltage of 0 to 10 VDC, or 0 to Controller Supply Voltage (Potentiometer), corresponding to an internal value of 0 to 1023.

AI.pm3

See Help: double-click on the block and click on **?**.

The type of Analog input can be selected from the Parameters window. This is then displayed in the Edit and Supervision windows. These include: Analog Input (by default), Analog Input 0-10V, Potentiometer, and Temperature.

Filtered inputs: These types of inputs can be used to suppress interference.

DI_1.pm3

Management of a light signal which is activated when 10 products are at the end of the line. Since the product is subject to bounce on arrival at the sensor, the input should be filtered.

See Help: double-click on the block and click on **?**.

DO (Discrete output): on/off output.

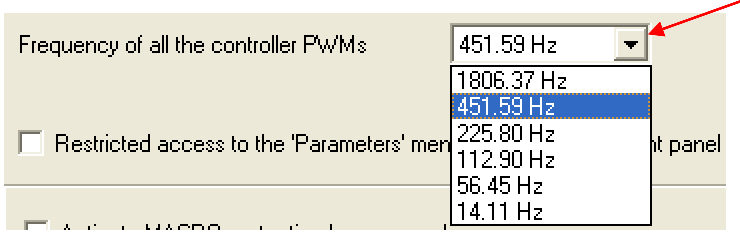
The type of discrete output can be selected from the Parameters window: Discrete Output, Normally open relay, Lamp, Solid state relay, Valve, Actuator, Motor, Resistance, Audible signal, Green indicator light, Red indicator light, Orange indicator light, Indicator light, Heating, Fan.

DO.pm3

See Help: double-click on the block and click on **?**.

PWM (Pulse Width Modulation) output: PWM outputs are available on controllers with solid state (transistor) outputs. The value on this type of outputs can vary between 0 and 255.

The frequency for the PWM outputs on the base controller is set during programming by clicking on the PROGRAM button at the top of the wiring sheet and then going to the Configuration tab. This basic frequency can be selected from 14 Hz to 1806 Hz.



Frequency of all the controller PWMs: 451.59 Hz

1806.37 Hz
451.59 Hz
225.80 Hz
112.90 Hz
56.45 Hz
14.11 Hz

□ Restricted access to the 'Parameters' men… …t panel

PWM.pm3

See Help: double-click on the block and click on **?**.

NUM IN, NUM OUT: Used for exchanging 16-bit integers between the controller and a communication extension.

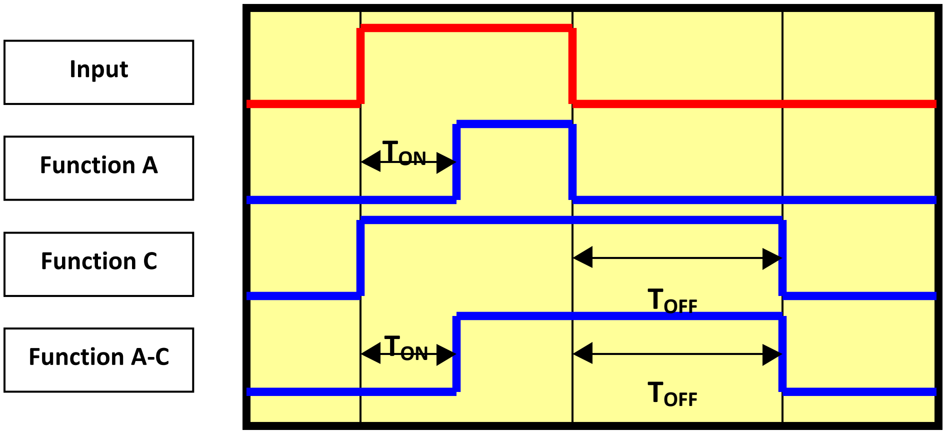
See Help: double-click on the block and click on **?**.

5.2 Control Functions:

Timers: You can select between 5 different types of timer functions.

After you place a timer block on the wiring sheet you can check the External setpoint box, if required: in this case the time delay setpoints will be integer-type inputs rather than being internal configurable parameters.

Timer A-C: Applies an ON delay, an OFF delay, or both delays to the output signal in relation to the input signal.



TIMER_A_C.pm3

In this example you can see how to create an A-C timer.

See Help: double-click on the block and click on **?**.

BW Timer: Generates a cycle duration pulse on a rising or falling edge or on both edges of an input, according to the setting chosen in the parameters.

TIMER_BW.pm3

This block can be used to convert pushbutton actions into pulses so they can be counted. If several pushbuttons are connected to a counter input and a user holds down the pushbutton, pressing the other pushbuttons would have no effect.

See Help: double-click on the block and click on **?**.

Timer Li/L: Generates pulses when the input is active. It can start in the ON part of the cycle (Li) or on the OFF part of the cycle (L).

TIMER_Li.pm3

This example shows how to make an alarm and the display flash.

See Help: double-click on the block and click on **?**.

Timer B/H: Generates a pulse (the time can be configured) on a rising edge of the input.

TIMER_BH.pm3

This example shows how this timer operates.

See Help: double-click on the block and click on **?**.

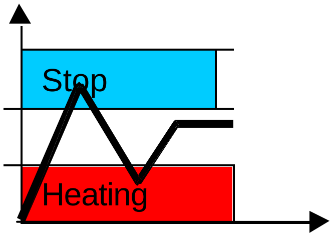
Totalizer function: It allows to count for how long the input has been held active (or inactive, depending on the mode selected). If the input is in the rest condition then the timing progress is held.
Several types of totalizer modes can be selected from the Parameters window: At, Ht, T, and Tt.

See Help: double-click on the block and click on **?**.

Schmitt Trigger: The output changes state if the input is lower than the minimum value, and the output changes state again if the input is higher than the maximum value. If the input is between the two, the output remains unchanged.

TRIGGER.pm3

This is an example of temperature regulation: the heating comes on when the input is lower than a certain temperature and goes off when this input reaches a given temperature.



See Help: double-click on the block and click on **?**.

Bistable: Provides the functionality of an impulse relay. An initial impulse sets the output to 1 then a second impulse is required to change the output back to 0.

BISTABLE.pm3

On this example the bistable is used to control lighting.

See Help: double-click on the block and click on **?**.

Set-Reset: Element consisting of two inputs: R for Reset and S for Set. To activate the output, simply generate a pulse on S; to deactivate it, generate a pulse on R. The priority defines the output state when both inputs are at 1.

SetReset.pm3

This is a motor controlled by a Run button and a Stop button.

See Help: double-click on the block and click on **?**.

1 sec: Internal clock with a period of one second.

1sec.pm3

Flasher System.

See Help: double-click on the block and click on **?**.

Comparison of two values: Compares two analog values using the >, ≥, =, ≠, ≤, and < operators. The output is discrete and it's activated if the comparison is true.

COMPARE.pm3

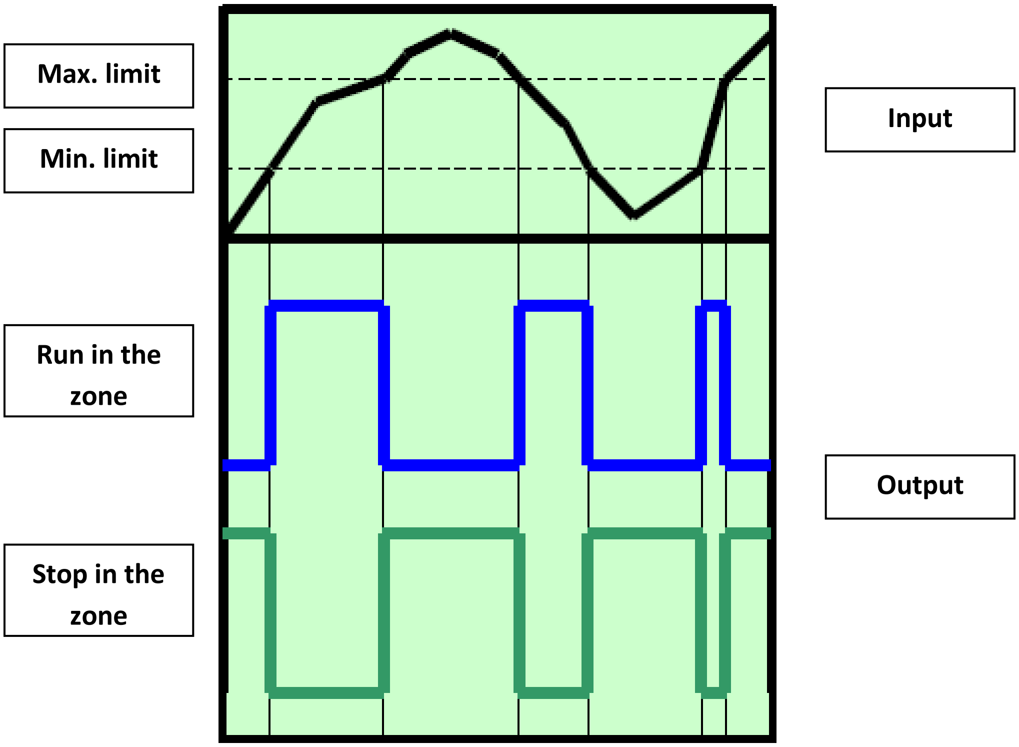
This program example is used to activate the output if both inputs are the same.

See Help: double-click on the block and click on **?**.

Zone comparison: Compares a value between two setpoints (the min and max values delimit the zone).

VAL.pm3

Checking a voltage: If the voltage is > 6V or < 4V then the bell rings.



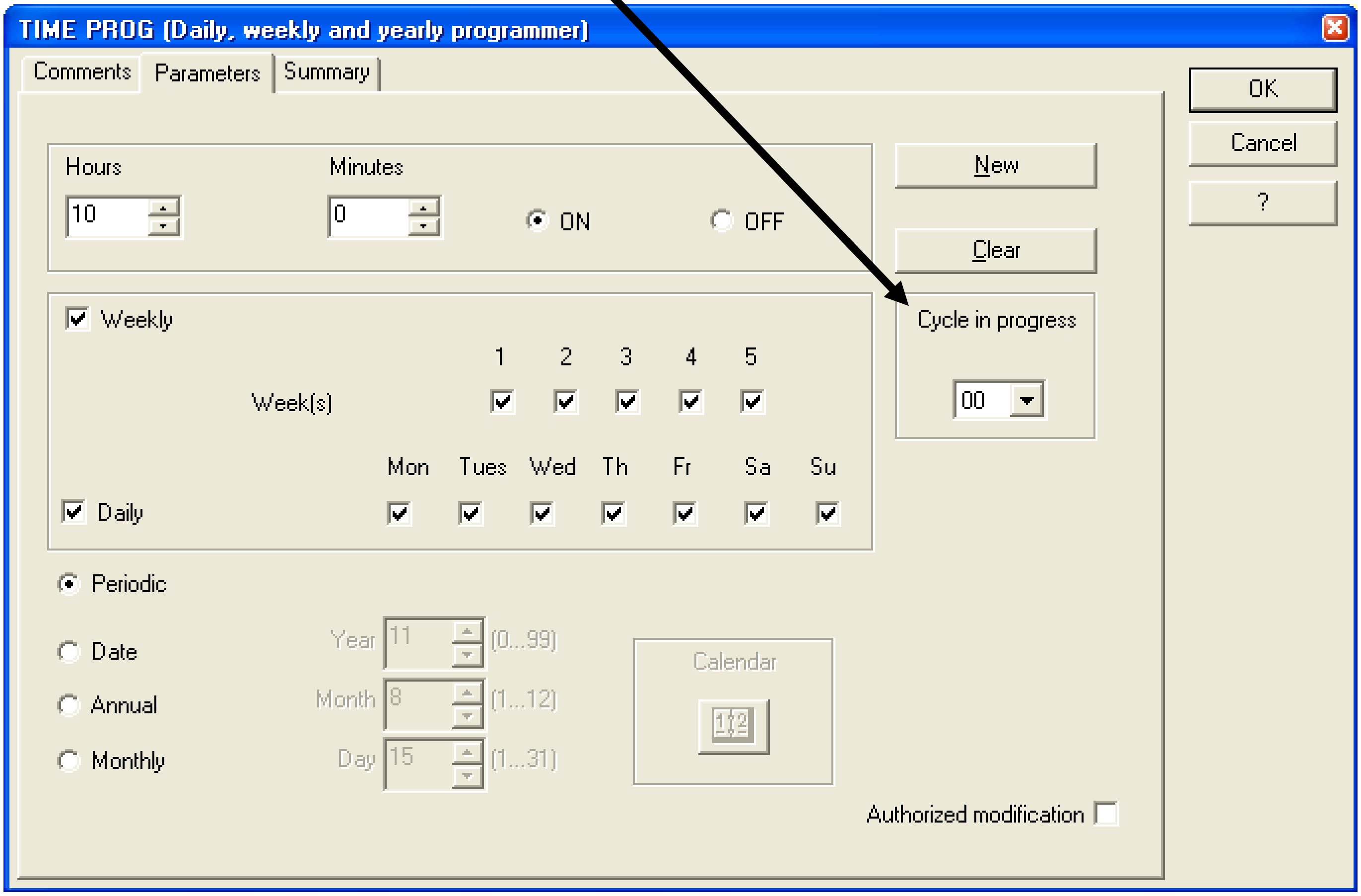
See Help: double-click on the block and click on **?**.

Time Prog (Daily, Weekly and Yearly Programmer): Activates or deactivates the output at a precise moment in the day, week or year. This block works on the event principle. To create an event, go into the Parameter tab, enter an active event number. Choose the time when this event occurs, then define the state of the output at this instant. You can select the frequency of this event. You can use the calendar at the right of the screen.

Number of programmed events.

Display event No. 0.

The summary index gives the description of programmed events.



TIME PROG (Daily, weekly and yearly programmer)

Hours 10 Minutes 0 ● ON ○ OFF

☑ Weekly

	1	2	3	4	5
Week(s)	☑	☑	☑	☑	☑

	Mon	Tues	Wed	Th	Fr	Sa	Su
☑ Daily	☑	☑	☑	☑	☑	☑	☑

● Periodic

○ Date Year 11 (0...99)

○ Annual Month 8 (1...12)

○ Monthly Day 15 (1...31)

Cycle in progress 00

Authorized modification □

Time_Programmer.pm3

In this example the Time Programmer is used as an alarm clock.

See Help: double-click on the block and click on **?**.

Counter: Function used for counting up to a value defined in the parameter-setting window. Once this value has been reached, the output changes to 1 until reset if the fixed output is selected or for a certain period if the pulse output is selected. The count value and the maximum value can be displayed.
The user has the option of counting from zero to the defined value or from the defined value to zero.

PRESET_COUNT.pm3

Here is a conveyor carrying parts to be packed. After every 5 parts the conveyor stops and the operator packs the parts. Then he presses the button again to reset the counter and thus restart the conveyor.

See Help: double-click on the block and click on **?**.

Preset Hour Counter: Measures the duration of the input state at 1. After a preset duration, the output changes state. This block can, for example, be used as an alert on a machine for maintenance purposes.

HH_MM.pm3

This is the principle used to warn of the need for maintenance. Every 30 hours of operation, to change a filter on the machine, for example.

See Help: double-click on the block and click on **?**.

5.3 HMI/Communication Functions:

Display on the LCD Screen: Displays text or an integer on the LCD screen on the controller front panel. For example, you can display a decimal derived from an integer. For more details, please refer to the example.

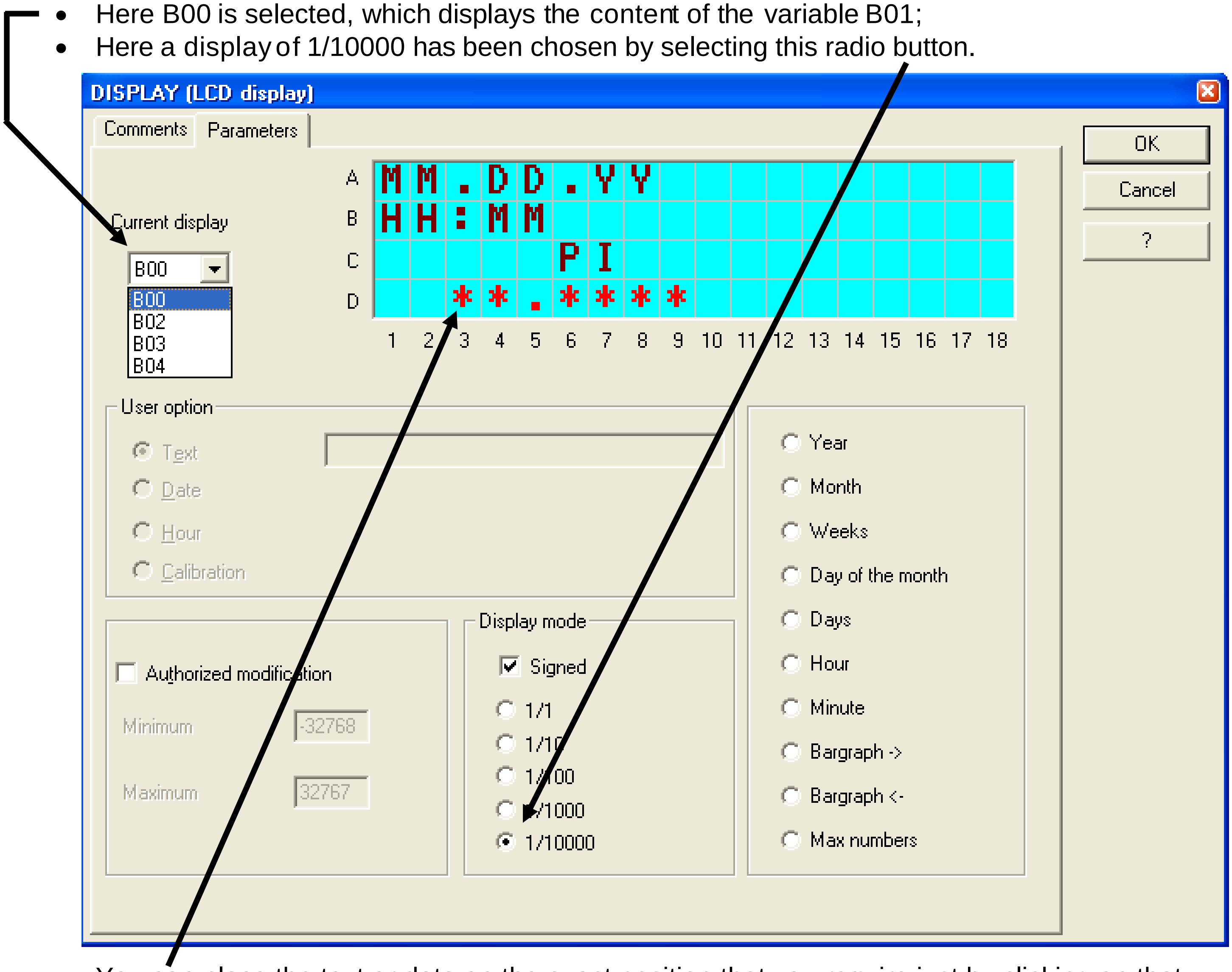
The Display function is used to display text, variables, and the time and date on the Millenium display.

You can have up to 8 Display blocks active. They are placed on the screen based on the numbering. If you have more than 8 Display blocks active at the same time only the first 8 blocks will be displayed.

The function window is used for displaying the variable with decimal places and for editing the text.

In this example 4 display blocks are used:

- Here B00 is selected, which displays the content of the variable B01;
- Here a display of 1/10000 has been chosen by selecting this radio button.



DISPLAY (LCD display)

Current display: B00

```
A  MM.DD.YY
B  HH:MM
C       PI
D    **.****
```

Display mode: ☑ Signed, ● 1/10000

- You can place the text or data on the exact position that you require just by clicking on that position on the grid.

Note: Calibration compensates for drifting of the Millenium clock. If the calibration button is activated the display will allow modification of this value. The unit is in seconds per week.

LCD.pm3

This is an example of using the controller's LCD display. The date, time, text and a decimal value(from an integer) are displayed on it.

See Help: double-click on the block and click on **?**.

TEXT function: Displays text and/or numerical values on the LCD screen on the controller's front panel. You can connect up to 4 numerical values to the same block and locate them, along with text, on the screen. You can also display the date and time and the calibration value for the clock drift.

This function doesn't allow for any special formatting on the numerical values. If that is required then the Display block has to be used.

You can only have **one** Text block active at the same time, since it covers the entire screen. If you have more than one active only the block with the highest number will be displayed.

TEXT.pm3

Example of use of the Text function. The date, time, text, and a couple of numerical values are displayed on two different screens.

See Help: double-click on the block and click on **?**.

LCD backlighting: This block is processed like an output. When it is active it activates the backlighting of the display

See Help: double-click on the block and click on **?**.

Buttons: You can use the buttons on the front panel of the Millenium in your application: A, B, ESC, OK, + and -.

ABEscOK.pm3

This example shows how to use the front panel keys on a program.

See Help: double-click on the block and click on **?**.

SL In, SL Out: Used for transmitting and receiving data via a serial link through the programming port of the controller. You have 24 input addresses and 24 output addresses. The SL In Protected block is used when you want to protect the data in case of a power failure.

SLIN-SLOUT.pm3

Use of SLIN and SLOUT functions to interface with an HMI.

To set the address range on the SL In and SL Out functions, simply double-click on the block or right-click and select the parameter-setting window. See Help: double-click on the block and click on **?**.

5.4 *Programming Functions:*

Constants: You can use constants to set values on certain function blocks. There are both numerical and discrete constants.

NUM.pm3

See Help: double-click on the block and click on **?**.

YES, YES NUM: These function blocks are very useful on macros. They allow for an input to be connected to several blocks inside a macro. The YES block is for discrete signals and the YES NUM block is for numerical signals.

See Help: double-click on the block and click on **?**.

Memory function: Used for saving a numerical value. When the Archive input changes from 0 to 1 the value at the output is replaced by the value on the input. You can select whether you want to keep this value or not in case of a power failure.

See Help: double-click on the block and click on **?**.

5.5 Calculation Functions:

Gain: Allows the use of a scale factor and is applicable to all analog data.

Example: This is a program which uses a counter, a comparator, a gain and the counter read-out display. An alarm is activated after the sensor has been passed 20 times.

GAIN.pm3

In this example, an alarm is activated after the sensor has been passed 20 times. The number of impulses is divided by 5.

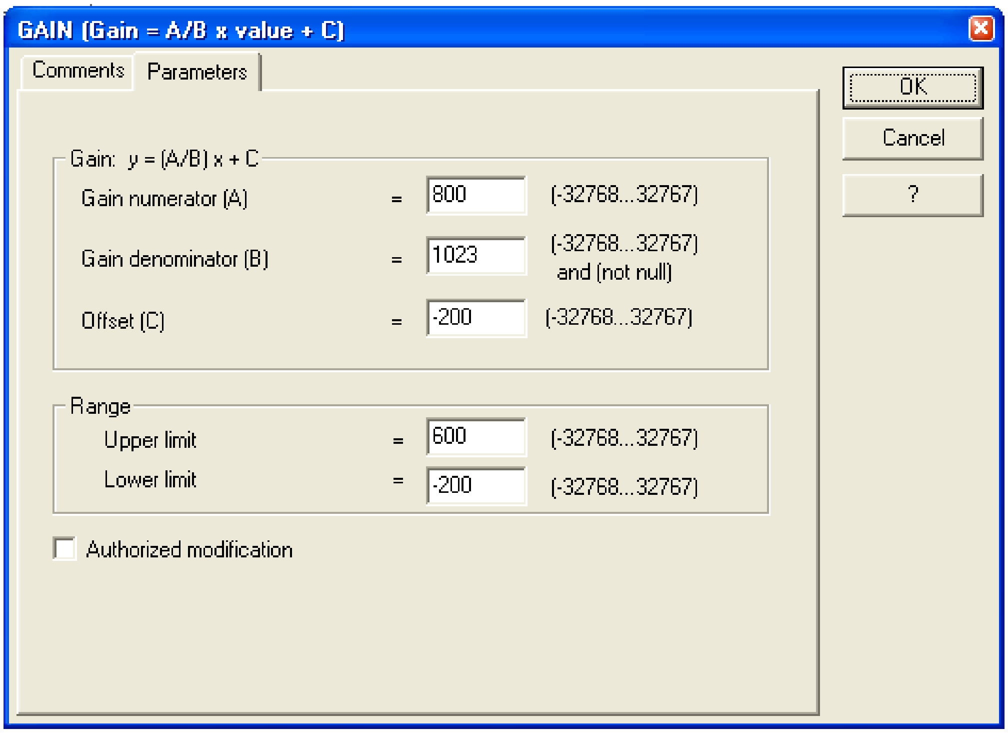
See Help: double-click on the block and click on **?**.

Example of a gain function used for displaying the temperature measured by a PT 100 temperature probe between -20 and + 60°:

- The measurement scale A = 80 (-20 to +60); these 80°C are divided into 1024 points.
- The offset corresponds to -20°C; the limit display values would be 60 and -20.

Range: 800
Resolution: 0 to 1023
Min. Value: -200

Max. Temp: 60.0 °C
Min. Temp: -20.0 °C



GAIN (Gain = A/B x value + C)

Comments | Parameters

Gain: y = (A/B) x + C

Gain numerator (A)	=	800	(-32768...32767)
Gain denominator (B)	=	1023	(-32768...32767) and (not null)
Offset (C)	=	-200	(-32768...32767)

Range

Upper limit	=	600	(-32768...32767)
Lower limit	=	-200	(-32768...32767)

☐ Authorized modification

This example combines some blocks that have already been introduced in order to control temperature and display it on the screen. The Gain function is used to convert the data provided by the sensor into a more useful format.

In this example, the chosen display is 1/100°C and therefore all the parameters of the Schmitt Trigger function and the Gain function should be multiplied by 100 with the exception of the 1023 denominator constant.

GAIN_1.pm3

Arithmetic functions: Perform arithmetic operations on numerical integers. You can do additions, subtractions, multiplications and divisions.

If an input is not connected it is set to 0 (ADD-SUB) or to 1 (MUL-DIV).

See Help: double-click on the block and click on **?**.

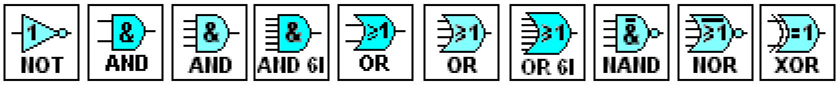
Word-Bit conversions: Allow to break down an integer into individual bits or to take the individual bits and form an integer with them. Each integer consists of 16 bits.

These function blocks are especially useful when there is communication (Modbus, Serial Link) involved in the application since the data exchanged are words and sometimes you need to address individual bits.

See Help: double-click on the block and click on **?**.

5.6 Logic Functions:

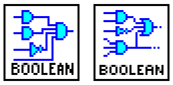
Logic Gates:



Logic gates can be used to construct logic (combinational) circuits.

The available functions are NOT, AND, OR, NAND, NOR, and XOR. They are available on 2, 4 and 6 input versions, depending on the function. Only the inputs connected are taken into account.

See Help: double-click on the block and click on **?**.

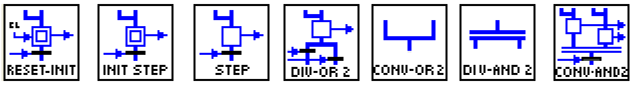


Boolean functions: On these functions the output(s) react(s) according to the truth table described in the parameters. There is one version with 4 inputs and 1 output and another version with 6 inputs and 2 outputs. Only the inputs connected are taken into account.

BOOLEAN.pm3

See Help: double-click on the block and click on **?**.

5.7 SFC/Grafcet Functions:



SFC functions are similar to Grafcet language. The principle is simple, since it involves sequential programming, with steps succeeding one another surrounded by transitions. When a step is active, wait for the next transition to become active in order to go to the next step.

SFC.pm3

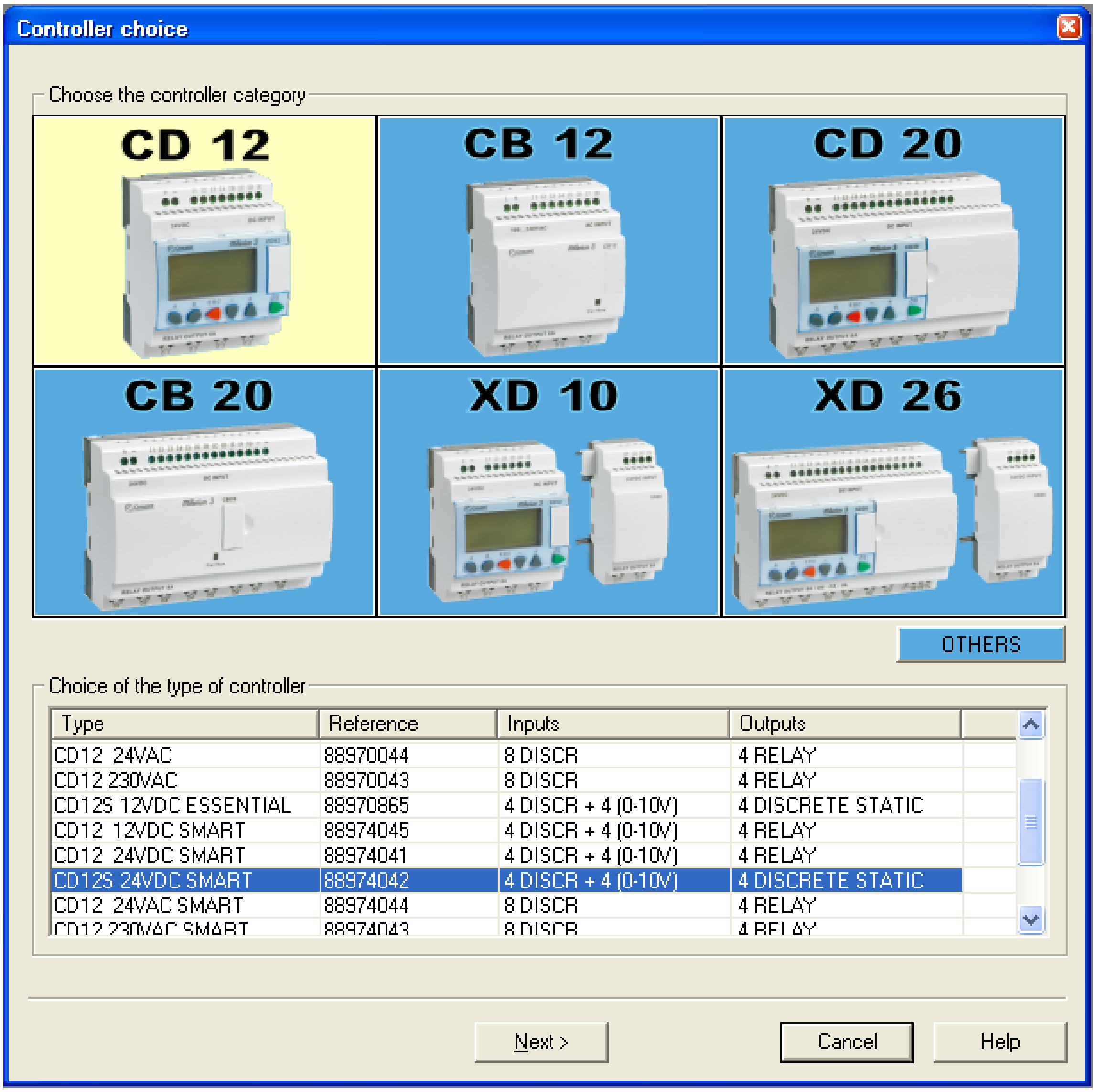
This example shows the sequence of a program using SFC functions.

See Help: double-click on the block and click on **?**.

6 STARTING AN APPLICATION

6.1 The Edit window

Select New File and click the type of Millenium that you have chosen. Select the part number corresponding to the controller.

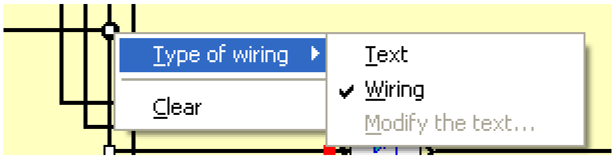


Type	Reference	Inputs	Outputs
CD12 24VAC	88970044	8 DISCR	4 RELAY
CD12 230VAC	88970043	8 DISCR	4 RELAY
CD12S 12VDC ESSENTIAL	88970865	4 DISCR + 4 (0-10V)	4 DISCRETE STATIC
CD12 12VDC SMART	88974045	4 DISCR + 4 (0-10V)	4 RELAY
CD12 24VDC SMART	88974041	4 DISCR + 4 (0-10V)	4 RELAY
CD12S 24VDC SMART	88974042	4 DISCR + 4 (0-10V)	4 DISCRETE STATIC
CD12 24VAC SMART	88974044	8 DISCR	4 RELAY
CD12 230VAC SMART	88974043	8 DISCR	4 RELAY

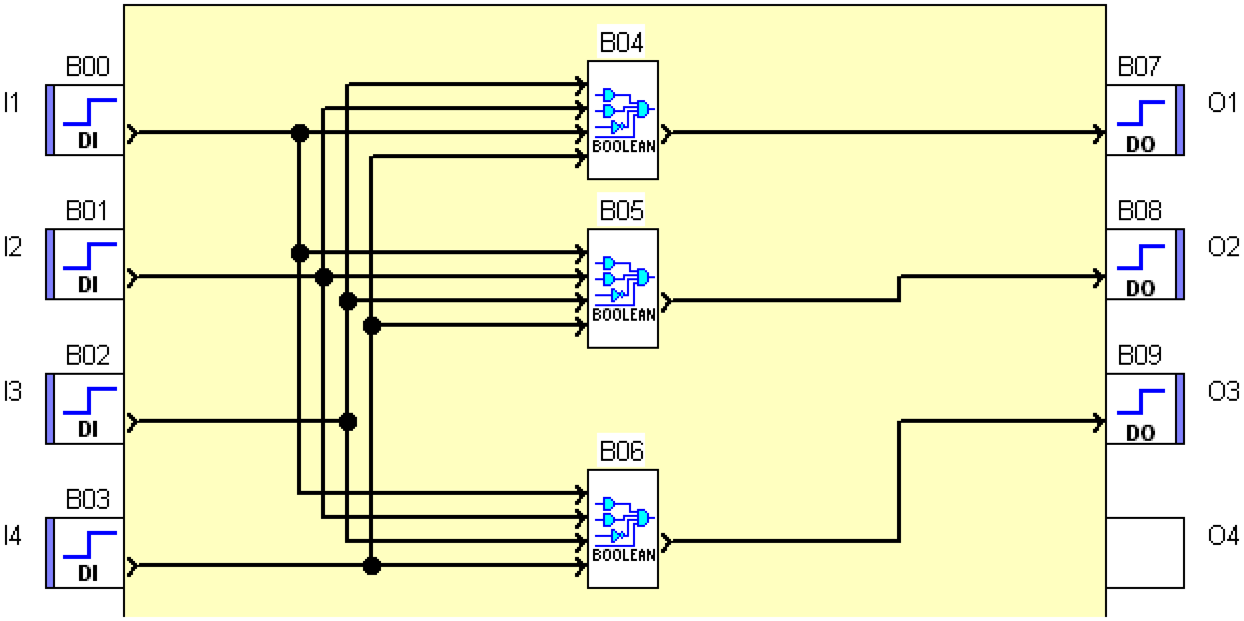
The edit window opens with a blank wiring sheet and you are ready to build your application. The part number of the selected Millenium controller then appears at the top of the wiring sheet.

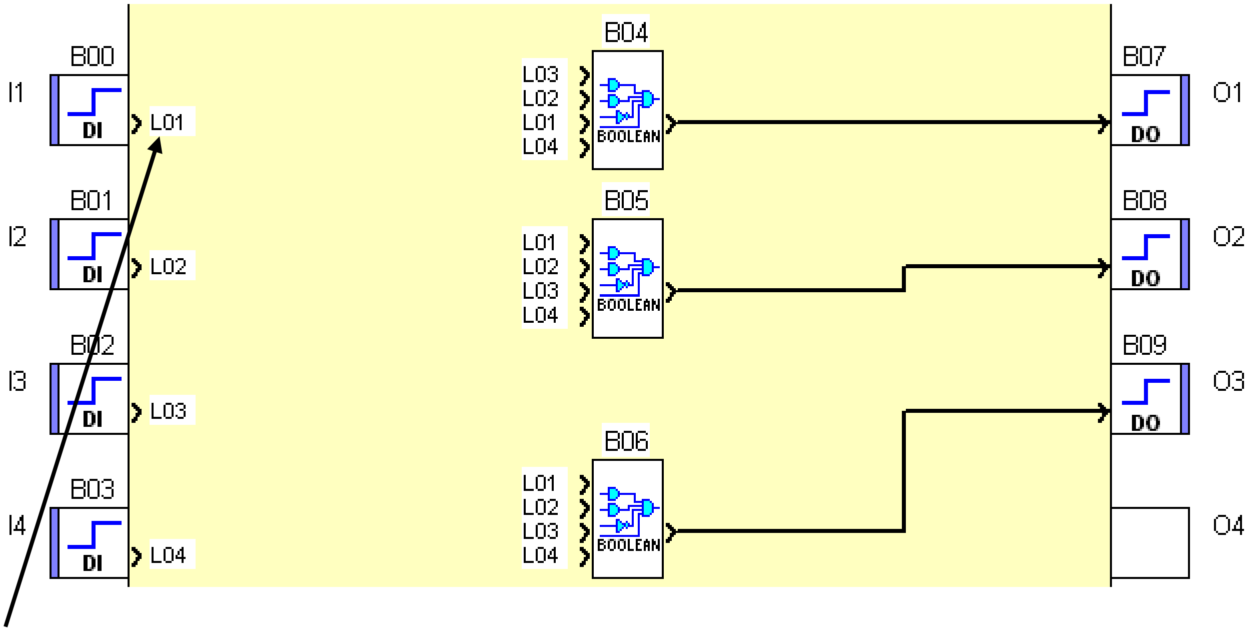
Blocks are positioned by clicking on the block, holding down and dragging it onto the programming page. Links between blocks are created directly by selecting block inputs and outputs. In the wiring mode tool, you can choose wire as the wiring type, and you will see the links between the various elements. If you choose text mode, the links will be marked but they will no longer be visible.

To change this parameter, right-click on a link and select the wiring type: wire or text.



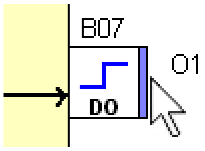
Example of wiring:





You can choose the text to place for each connection. Just position the cursor on the desired connection, right-click with the mouse, choose *Type of Wiring* and *Modify the text*.

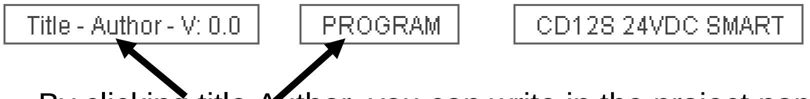
When you want to move an input or output which is already assigned to an element you can move it by using the handle on the side.



It is possible to change an input or output type. This option does not affect operation.
If you want to change an input or output type, simply double-click on the icon and choose an alias. On the wiring page, you can add a comment and drawings. To do this, you can use the draw toolbar and also the draw menu bar.
To change the line thickness, the line color or the background color, you need to select the element and click on the icon associated with the desired action in the toolbar.

6.2 Editing your program: Edit mode

At the top of the wiring page you can see these three buttons.



Displays the selected millennium 3

- By clicking title Author, you can write in the project name, date and author.
- By clicking Program, you can select the application **cycle duration** (10ms by default).
- Then you can choose the date format.
- If you are using PWM outputs, you can select the frequency of all the PWM outputs (by default 1806.37 Hz).

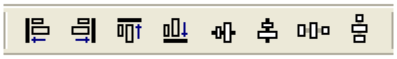
To build your application:

Select the input blocks and place them on the input terminals, select the output blocks and place them on the output terminals.
Select the function blocks, create the wiring between the various points. Double-click on the functions in order to set the parameters.

Each function block is numbered in the order of placing the blocks on the programming page. Deleting blocks results in a break in the numbering. To renumber, select the blocks then **Tools**, **Renumber functions.**

In text mode wiring, each link is numbered in the order of placing the wiring on the wiring page. Deleting links results in a break in the numbering. To renumber, select the links then **Tools**, **Renumber links.**

By selecting a number of blocks, you can align them according to the icon on the Draw bar. Align left, right, center, etc.



6.2.1 Supervision

Select **window** then **Supervision**. Simply drag the inputs/outputs and function blocks of your choice from the wiring page to the supervision window. You can illustrate your application using the draw tools. You can also choose a .BMP background image by right-clicking in the supervision window; Modify background, Bitmap.

This window explicitly displays the elements you have dragged from the wiring page in their own environment. When you change to simulation or monitoring mode, the inputs and the outputs are updated; it is also possible to force an input in the same way as with the edit window. Here is an example of using supervision mode:

SUPERV.pm3

6.2.2 Import

You have the option of recovering all or part of the programming page of an existing file. To import a wiring scheme, you should already have opened a file. First select File, then Import. Next choose the file to be imported. When importing a wiring scheme, you will see that the previously opened file stays open. You can therefore drag a selection from the edit window of the imported wiring scheme to the edit window of the previous wiring scheme.

6.3 Testing your program: Simulation mode

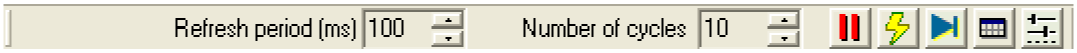
Our software also lets you fully test your program before implementing it. Simply select **S** or simulation mode. Simulation on discrete or analog inputs can be temporary or permanent. Force the input or output by clicking on the link or on the input or output pin. It is not necessary for the controller to be connected to the PC to perform simulation.

6.3.1 Front panel display

In simulation mode, click on **Window** then on **Front Panel**. The keys illustrated on the front panel are activated by clicking and holding down.

6.3.2 Simulation mode parameters

The monitoring/simulation bar is used to change the number of cycles executed at each simulation stage, and is similar to a time multiplier. Moreover, the refresh period is the frequency at which the output and parameter values are updated in the application window.



Refresh period (ms) 100

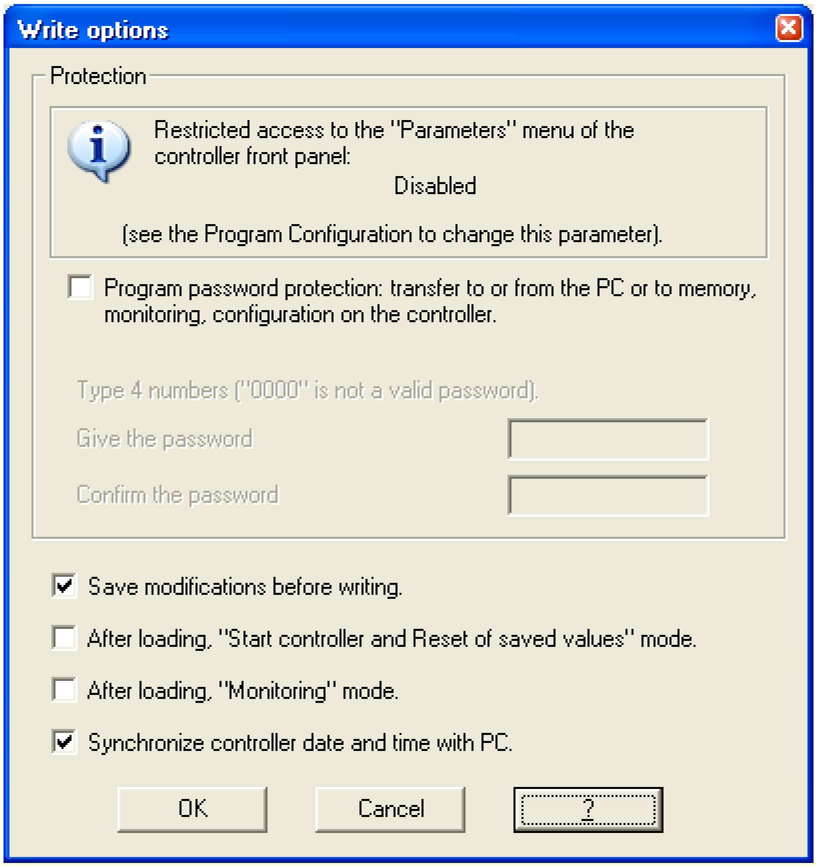
Number of cycles 10

6.4 Writing to the controller and running

Once your application has been debugged and verified, you can transfer it to the Millenium controller. The Write to the controller function translates the program into data that can be loaded into the controller and transfers it from the PC to the controller.

To write data to the controller, it must be in STOP mode. After the program has been stopped go into the Controller menu, click on *Write to the controller*.

This option will open the Compilation Results window. If the compilation is successful then following windows appears:



Write options

Protection

Restricted access to the "Parameters" menu of the controller front panel:
Disabled

(see the Program Configuration to change this parameter).

□ Program password protection: transfer to or from the PC or to memory, monitoring, configuration on the controller.

Type 4 numbers ("0000" is not a valid password).

Give the password

Confirm the password

☑ Save modifications before writing.

□ After loading, "Start controller and Reset of saved values" mode.

□ After loading, "Monitoring" mode.

☑ Synchronize controller date and time with PC.

6.5 Monitoring mode

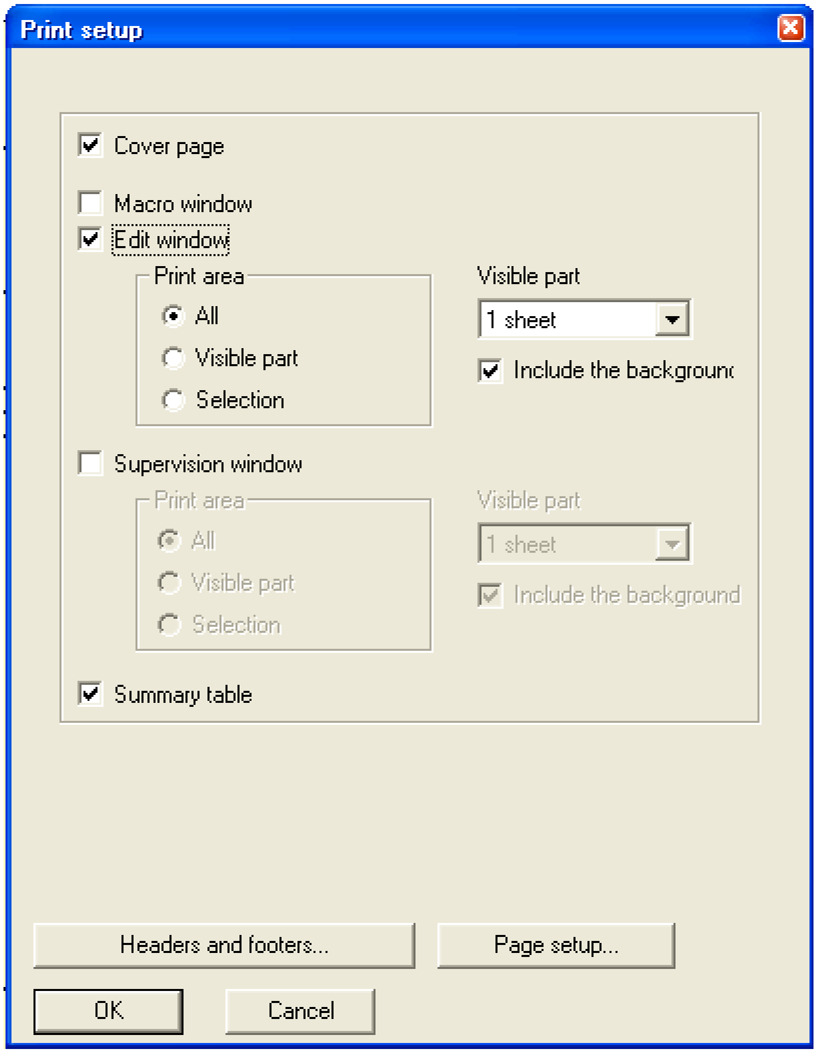
In Monitoring mode the controller has to be connected to the PC. This mode has the same characteristics as in the simulation mode. The state of any Millenium inputs and outputs can be displayed or changed from the software workshop. These inputs are visible from the edit window and the supervision window. The front panel is used to monitor the process and operate the keys remotely by selecting the front panel window.

6.6 Printing your application

You can print a complete application listing. Printing an application provides full documentation for the application. It consists of:

- A wiring diagram for the application,
- Wiring diagram(s) of macro(s),
- The content of the Supervision window,
- A table with the following for each symbol:
  - A representation of the symbol,
  - Its block number,
  - The associated comment,
  - The parameters with their values and their descriptions

Select **File**, **Printer setup.** Select the required parameters. Before printing, select **File**, **Print preview**



Print setup

☑ Cover page

□ Macro window

☑ Edit window

Print area
● All
○ Visible part
○ Selection

Visible part: 1 sheet

☑ Include the backgrounc

□ Supervision window

Print area
● All
○ Visible part
○ Selection

Visible part: 1 sheet

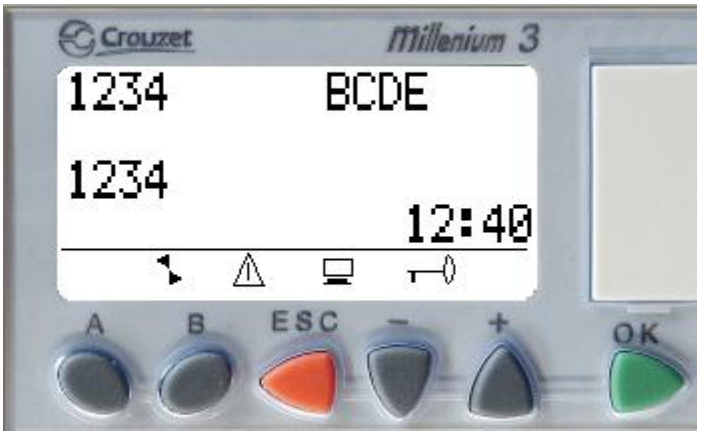
☑ Include the background

☑ Summary table

7 MILLENIUM IN RUN MODE

7.1 The display

This is the default screen for a Millenium without extension:



If no Display function is used, the Millenium displays the state of the inputs, the outputs, the time, and the diagnostic icons.

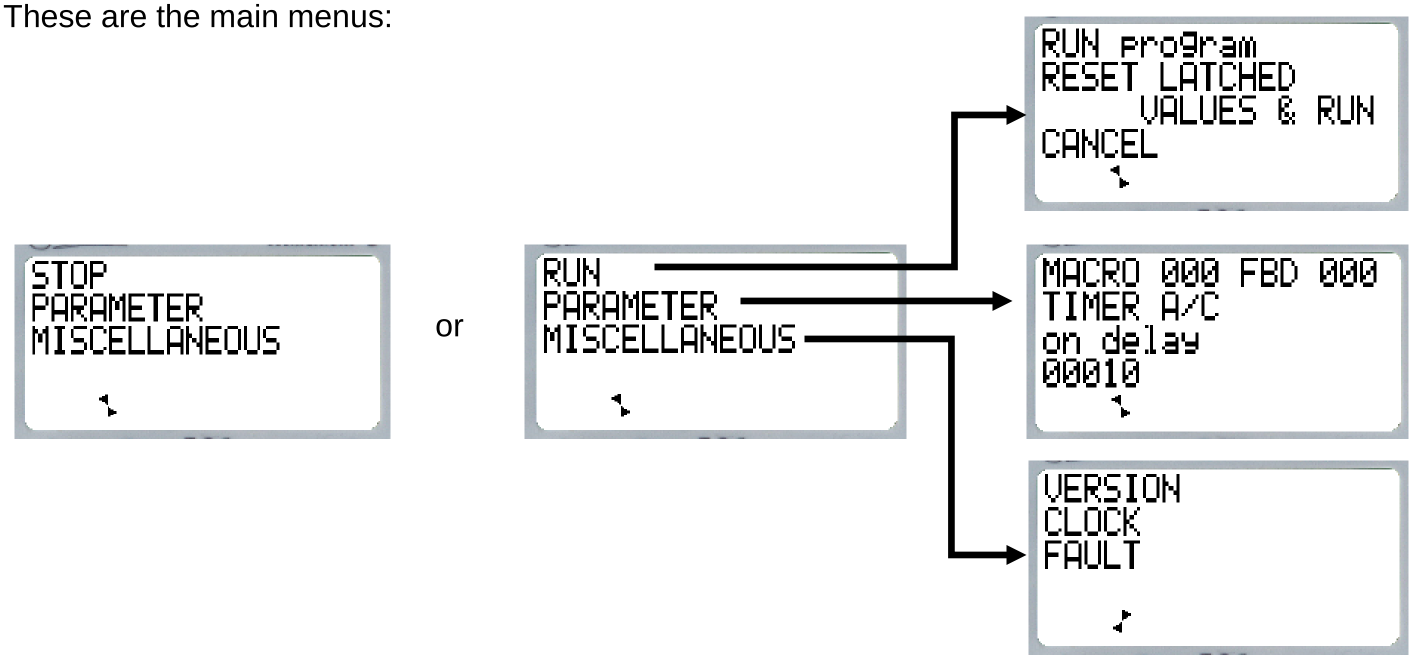
7.2 Accessing the menu

If the front panel lock option has not been activated, you access the menu by pressing **ESC** or **OK**.

If there is a display function in your program, to go to the menu you should press **ESC** and **OK** at the same time.

7.3 Menu structure

These are the main menus:



7.4 Run/Stop

Access the menu by pressing **ESC** or **OK**. If the Millenium is in RUN mode, the ▸ icon turns and the menu says STOP. If the Millenium is stopped, the ▸ icon is steady and the menu says RUN.

If you select RESET LATCHED VALUES & RUN on the RUN sub-menu then the values of the function blocks for which the Save on power failure option was checked will be reset.

7.4.1 Accessing the menu with a password

If the program on the controller is password protected the **key icon** (🔑) is displayed.

To access the menu you have to enter the password, using the **+** and **–** buttons. For example, if you want to enter the password 1250, hold down the **+** button and scroll rapidly until the value is approached, then release the button and scroll slowly, pressing repeatedly until you reach 1250. Then press **OK**.

You can make 5 attempts to enter the password. If you fail to enter your password correctly after 5 attempts, you can try again after 30 minutes.

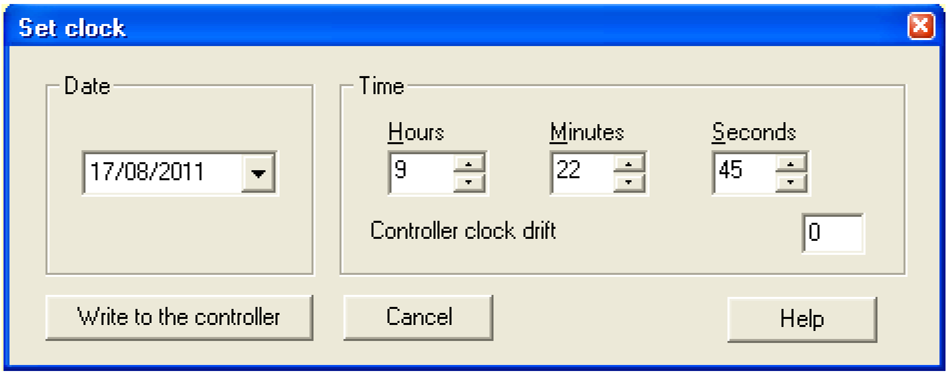
7.5 Setting the date and time

To ensure that the programs work correctly with time-based programming, the date and the time must be set accurately. The modifiable parameters are:

- Day / Month / Year
- Hours, Minutes, Seconds
- Controller clock drift, in seconds per week

7.5.1 Setting the time on the Millenium from the software workshop

From the software workshop: Go to the Controller menu and you can then select **Read/Write date and time**. You are then presented with the following dialogue box:



Set clock

Date: 17/08/2011

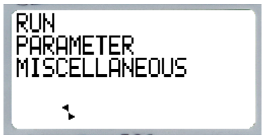
Time: Hours 9, Minutes 22, Seconds 45

Controller clock drift: 0

The controller’s time is displayed by default. You can modify this time if needed and then write it into the controller.

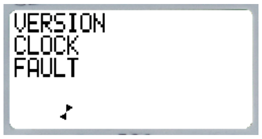
7.5.2 Setting the time on the Millenium from the front panel

First, go into the main menu. To do this, press **OK** or **ESC**. If the password is required, enter it. The following menu should appear:



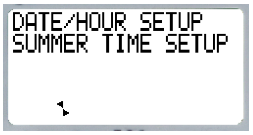
```
RUN
PARAMETER
MISCELLANEOUS
```

Press **-** twice until MISCELLANEOUS becomes the item that flashes. Press **OK**. The following menu should appear:



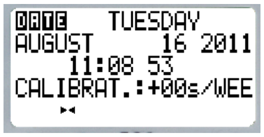
```
VERSION
CLOCK
FAULT
```

Now, scroll down to CLOCK, which flashes, and press **OK**. The following menu should appear:



```
DATE/HOUR SETUP
SUMMER TIME SETUP
```

Press OK and the following screen should appear:



```
DATE   TUESDAY
AUGUST     16 2011
    11:08 53
CALIBRAT.:+00s/WEE
```

To select a value to modify, you can browse using the **+** and **–** keys. To modify a value, select it then press **OK**. You can then modify the value by pressing the **+** and **+** keys and finally confirm by pressing **OK**.

7.5.3 Calibration

Calibration compensates for clock drift. The unit is in seconds per week. To modify this value, go into the time setting menu then select the calibration value. To modify it, press **OK**, then to change the value press the **+** or **–** keys and confirm with **OK**.

7.6 Values in the blocks which can be modified

It is possible to modify block parameters such as numerical constants, counters, timers, gain blocks, time programmers, etc. directly from the controller's front panel in two ways: by selecting the function block, or via the Display and Text functions.

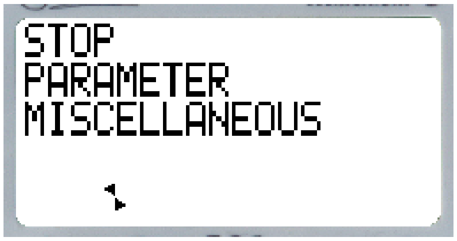
EX.pm3

Important: Make sure that the type of Millenium selected in the workshop is the same as the one you are using. Check this by clicking on **Tools** then **Choose the type of controller**.

Click on **Controller** then on **Write to the controller** to modify the parameters. Click Run.

7.7 *Modifying a value by selecting FBD blocks*

To go into the configuration menu press **OK** or **ESC**. Once in the menu, select PARAMETERS. To do this, press the **–** key until PARAMETERS is the flashing item. This screen will then appear:

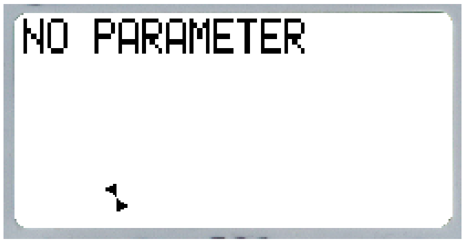


```
STOP
PARAMETER
MISCELLANEOUS
```

Now press **OK** to confirm. The black text flashes indicating that a value has been selected. To modify it, press **OK**.

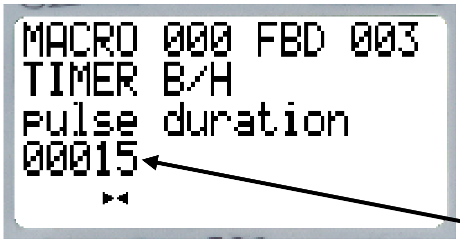
The value flashes when modification is possible. The **OK** key will switch from one mode to the other.

Note: NO PARAMETER means that there are no blocks with configurable parameters.



```
NO PARAMETER
```

In this example, the FBD number is B03. You should select 003. If you wish to select another configurable block, press **+**. When the required number is reached, confirm with the **OK** button.



```
MACRO 000 FBD 003
TIMER B/H
pulse duration
00015
```

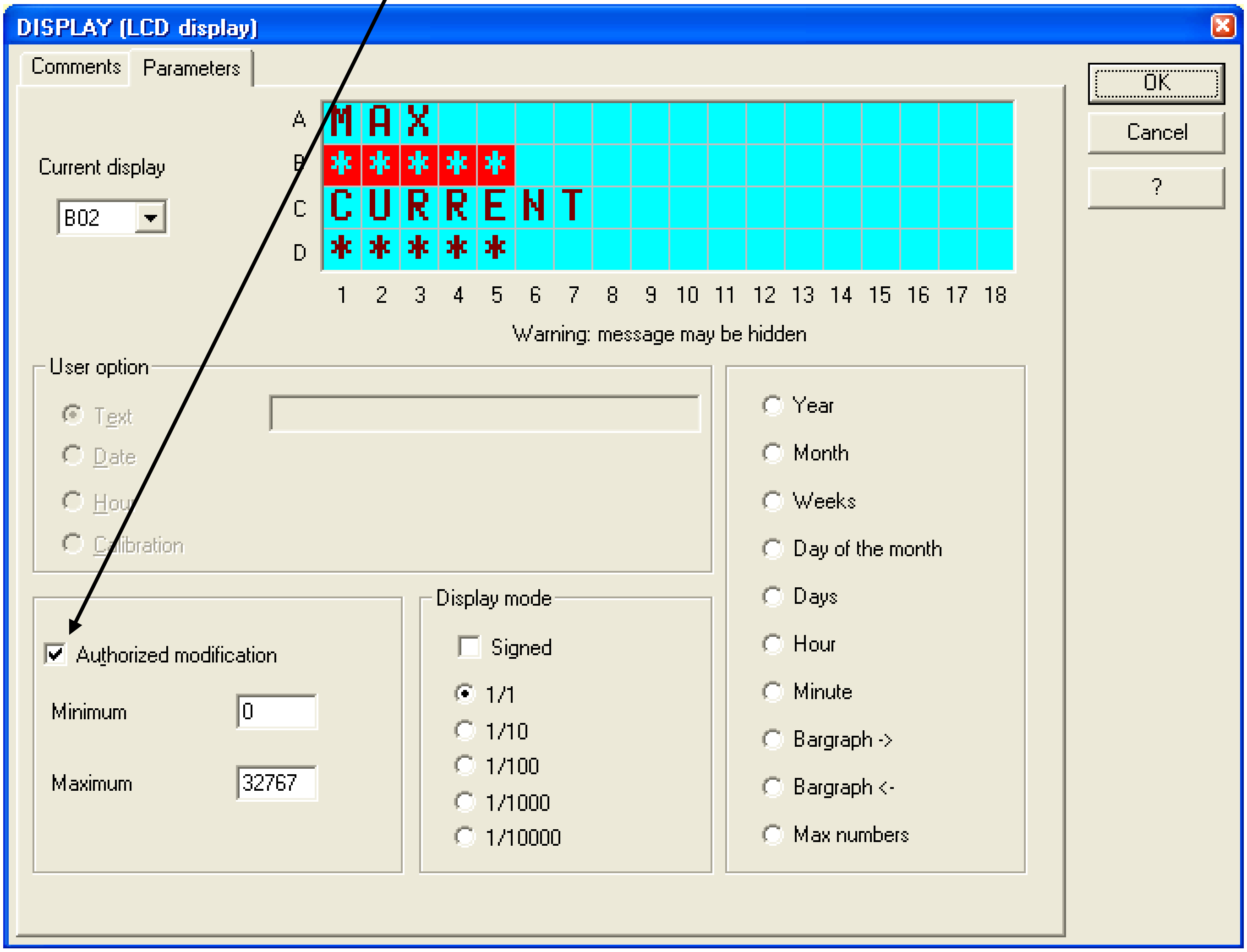
To browse the various parameters, select the type of parameter by pressing to obtain the parameters. Then press **OK**.

In this example, time delay B function is selected and the only parameter is the time delay duration

Select a new value and confirm with **OK** (enter a value of your choice and confirm with **OK**). If your program is running, you will see the change.

7.8 Modifying a variable using Display or Text blocks.

In this case, the variables to be modified should be wired to the analog input(s) of the function block. When the Authorized modification box is checked it is possible to modify the value.



Current display: B02

A: MAX
B: *****
C: CURRENT
D: *****

Warning: message may be hidden

User option
○ Text
○ Date
○ Hour
○ Calibration

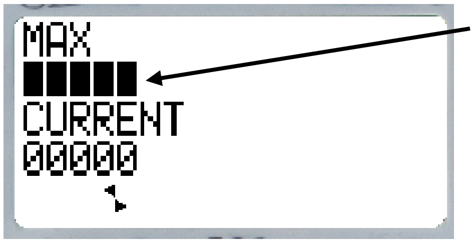
☑ Authorized modification

Minimum: 0

Maximum: 32767

Display mode
□ Signed
● 1/1
○ 1/10
○ 1/100
○ 1/1000
○ 1/10000

○ Year
○ Month
○ Weeks
○ Day of the month
○ Days
○ Hour
○ Minute
○ Bargraph ->
○ Bargraph <-
○ Max numbers


MAX
█████
CURRENT
00000

Continuous flashing indicates the value (or one of the values) that can be modified.

Select the value to be modified with the **+** and **-** keys; then **OK**. To modify the value press the **+** and **-** keys again. Then confirm with **OK**.

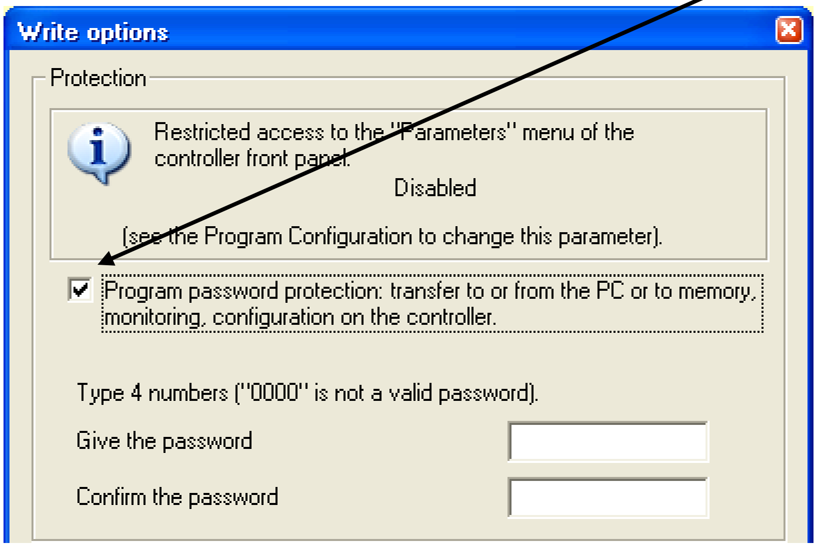
7.9 Fault

When a fault is detected on the controller, an icon ⚠ appears at the top of the display unit. You can view the error number by going into the main menu, selecting **MISCELLANEOUS** and then selecting **FAULT**. This screen displays the number of the last fault which appeared on the controller. Below is an error correspondence table:

Code	Type of warning
00	No faults.
01	Fault in writing to EEPROM (memory cartridge).
02	Clock write error.
04	Overload on solid state relay outputs.
50	Controller software is damaged.
51	Cycle overflow.
52	The controller has executed an unknown operation
53	Link between controller and bus extension faulty
54	Link between controller and Input/Output extension faulty.
58	A fault is present in the controller software or on a part of the controller hardware.
59	Application incompatible with the physically powered controller.
60	Program incompatible with the bus extension physically connected to the supply
61	Program incompatible with the Input/Output extension physically connected to the supply.
62	Version (or build number) incompatibility when loading a program from the backup memory.
63	Hardware configuration incompatibility when loading a program from the backup memory.

8 PASSWORD FUNCTION

You can password protect the access to a program. When you write your program to the controller the write option window opens. Check the box indicated here:



Write options

Protection

Restricted access to the "Parameters" menu of the controller front panel.
Disabled

(see the Program Configuration to change this parameter).

☑ Program password protection: transfer to or from the PC or to memory, monitoring, configuration on the controller.

Type 4 numbers ("0000" is not a valid password).

Give the password

Confirm the password

Once the password is active you can no longer write to the controller nor read the program without this password. The program is therefore protected.

If you wish to access the menu and, for example, reset the time you will be asked to enter the password.

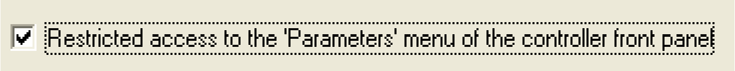
8.1 You have lost your password

If the password is lost, the only solution is to delete the program from the controller. To do this, go into the **controller** menu then select **delete the controller content**. It will then be possible to write a new program to the controller.

9 FRONT PANEL LOCK

The front panel lock function prevents any access to the menus. The lock is effective when the program is running, but also when it is stopped. To start or stop the program once the lock is active, you have to go via the software workshop. However, the front panel lock does not prevent use of the front panel buttons in a program.

To activate the front panel lock go to the **Program configuration** tab and check the option **"Restricted access to the 'Parameters' menu of the controller front panel"**.



☑ Restricted access to the 'Parameters' menu of the controller front panel

When you write to the controller this option will be applied to your controller.

9.1 Unlocking the front panel

To unlock the front panel, uncheck the **"Restricted access to the 'Parameters' menu of the controller front panel"** option and rewrite the program to the controller.

10 MEMORY MODULE

The memory module **88 970 109** can be used to backup a program. The Millenium can both write and read a program from the cartridge.

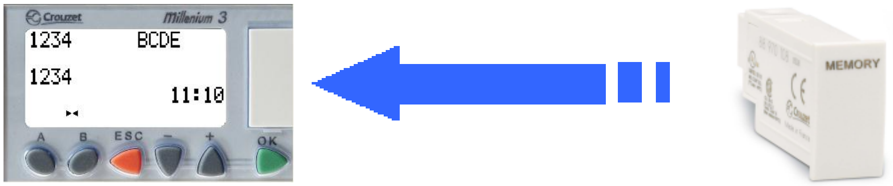
10.1 Saving a controller program to the module

Insert the memory module into the Millenium with the front panel unlocked. Saves are performed in STOP mode.

Save procedure:

- Go into the main menu by pressing the **ESC** key. Select **MEMORY CARD**. You will have two Save options available:
  - Save without front panel lock (**SAVE**),
  - Save with front panel lock (**SAVE & LOCK KEYPAD**).

10.2 Transferring a module program to the Millenium



10.2.1 Sequence

Insert the memory module into the Millenium with the front panel unlocked. Saves are performed in STOP mode.

Go into the main menu by pressing the **ESC** key. Select **MEMORY** CARD and then select **RESTORE**. The new program is then saved in the cartridge.

Note: It is recommended that the memory module is inserted or removed with the power off.

10.2.2 The front panel is locked

To load the program, insert the cartridge with the controller powered off and then simply switch the controller back on; the program in the cartridge will load automatically and will overwrite the program previously held in the Millenium without confirmation.

10.2.3 The Millenium program is protected by a password

If the program on the Millenium is protected by a password, you will need to know it in order to be able to load the program from the memory module.

10.2.4 The controller program is protected by a password and the front panel is locked

In this case, to load a program, the password for the program contained in the cartridge must be the same as that in the Millenium for the update to take place.

10.3 Comments on using the memory module

Writing or reading the memory cartridge can be done only on a Millenium controller. You should not use the cartridge in RUN mode except in cases where the Millenium has an LCD display and the front panel is not locked (when the front panel is locked the EEPROM is only written to each time the module is switched on).

10.4 Example: How to use the memory module

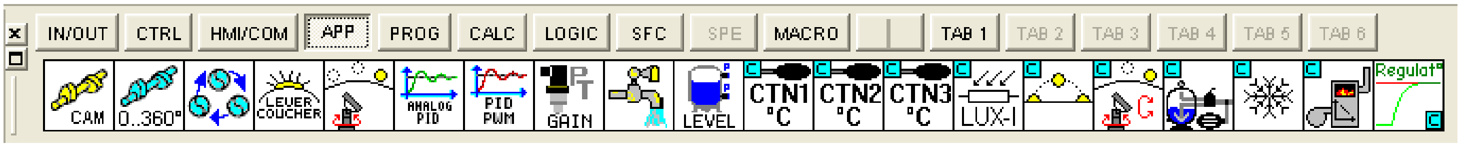
An OEM manufacturer uses the Millenium controller in his machines. The program contained in the controllers is protected by a password, and the front panel has been locked to prevent customer intervention. This manufacturer makes an update to his program. To avoid sending a staff member out to every customer, he sends out a memory module. The customer simply has to insert the cartridge in the controller, switch off the power for a few seconds, switch the unit on again, and finally remove the cartridge. The program contained in the cartridge should be protected by the same password as the program it replaces.

11 APPLICATION-SPECIFIC FUNCTIONS

Application-specific functions are special function blocks developed to solve common application problems. Some of these functions are only available on controllers of the SMART range (the icons are marked with a **C** on the corner).

11.1 Application-specific functions in the software workshop

Most of the Application-specific functions are found in the function bar in the **APP** tab.

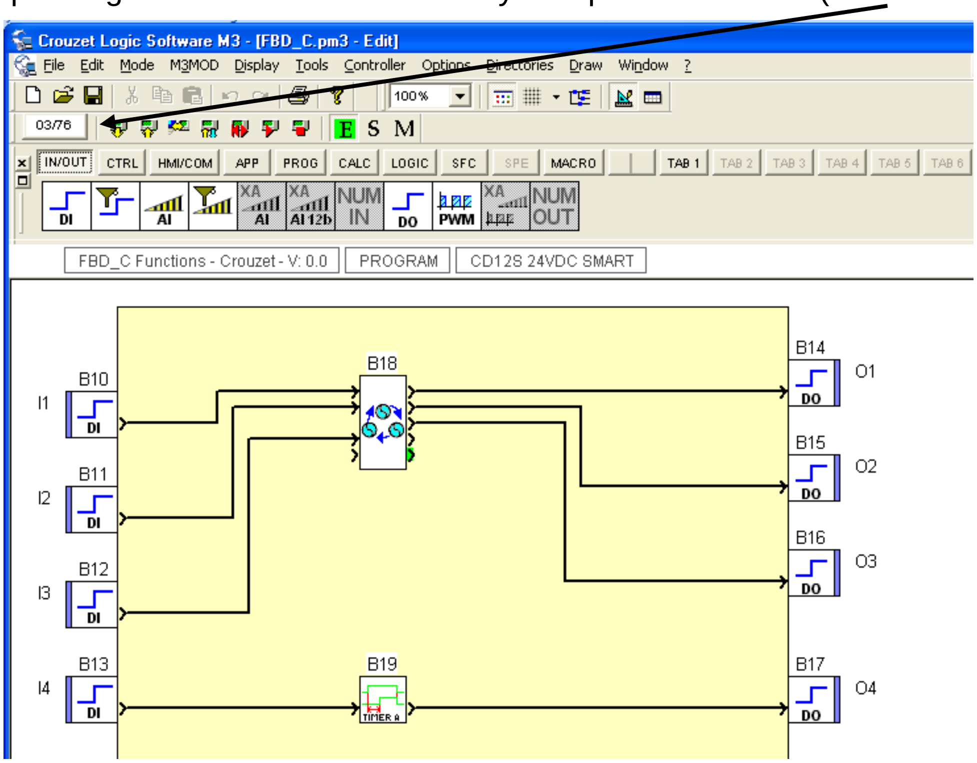


See description in the window for each function by clicking Help **?**.

You can put several application-specific functions in the wiring page. You can also place the same application-specific function in several times.

11.2 Application-specific functions in the Millenium

The Millenium can only hold a limited number of application-specific function slots. When loading a program which contains 1 or more application-specific functions, you can find out the Millenium's availability by pointing the cursor here. Availability is expressed in slots (44 or 76 in total).


Crouzet Logic Software M3 - [FBD_C.pm3 - Edit]

03/76

FBD_C Functions - Crouzet - V: 0.0 | PROGRAM | CD12S 24VDC SMART

FBD_C.pm3

Note: *The number of application-specific function blocks used in the application is not linked to the number of slots available in the Millenium*.

11.3 Made-to-order application-specific functions

To resolve an specific application problem please consult us for help in designing your application-specific function.

12 COMMUNICATION OPTIONS

12.1 Communication via Modbus Extension

The Modbus protocol is a master/slave protocol that allows one, and only one, master to request responses from slaves, or to act based on the request.

To use Modbus functions, a Modbus XN03 or XN06 extension must be added to an expandable controller (XD10, XD26, XB10, or XB26).

Modbus communication can be used in Ladder language and in FBD language.

Note: The Modbus extensions can only operate in Modbus slave mode.

12.1.1 Functional description

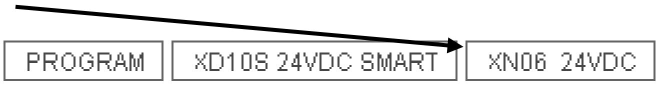
The Modbus extension has the following features:

- Connection on a Modbus network: 2 or 4-wire
- Maximum network length: 1000 meters (9600 bauds)
- Line terminated at both ends (Line terminators: 1nF, 10V, 120 ohms, 0.25 W in series)
- Polarized line (Pull Up/Down: 470 ohms/0.25W polarization resistor)
- Use of a shielded cable
- Male RJ45 connectors
- COMMON signal connected directly to the protection ground and to a point on the bus

12.1.2 Parameters setting

The Modbus properties of the extension module can be configured in the software workshop by clicking on **Files**, then on **Properties** and then going to the **Modbus sandwich extension** tab.

You can also get to this window by clicking on the name of the extension module at the top of the wiring sheet.



These are the available parameters:

- Number of wires and format:
  - 2-wire, RTU
  - 4-wire, RTU
  - 2-wire, ASCII
  - 4-wire, ASCII
- Speed in bauds:
  - Transmission speed (bauds): 1200, 2400, 4800, 9600, 19200, 28800, 38400 and 57600.
- Parity:
  - None
  - Even
  - Odd
- Modbus slave address:
  - Network address: 1 to 247

12.1.3 Data exchange

Depending on the extension module selected you have 8 or 16 16-bit data exchange words, four clock words and one status word.

These extensions support four Modbus functions: Read multiple registers, Write single register, Write multiple registers, and Read device identification.

Here you can see an example program using the XN06 Modbus extension:

MODBUS.pm3

For additional information please refer to the M3 Software Help files and to the installation sheets for these extension modules.

12.2 Communication via Ethernet Extension

Using the XN05 extension module you can communicate using the Modbus over Ethernet (Modbus TCP/IP) protocol. Modbus TCP/IP is based on a client/server model. Each Modbus server has an array of registers where clients can read or write data.

The XN05 extension can only be used with an expandable controller (XD10, XD26, XB10, or XB26). This extension works as a server on a network; it can only respond to messages that are sent to it.

Ethernet communication can be used in FBD language only.

12.2.1 Features

The Ethernet extension has an RJ45 female connector and two LEDs that provide the status of the communication: LK/ACT 10/100 and STS.

12.2.2 Parameters setting

The properties of the Ethernet extension module can be configured in the software workshop by clicking on **Files**, then on **Properties** and then going to the **Sandwich Ethernet Extension** tab.

You can also get to this window by clicking on the name of the extension module at the top of the wiring sheet.

These are the available parameters:

- IP Address Acquisition Mode:
  - Dynamic
  - Static
- In case Static mode was selected:
  - IP address
  - Sub-network mask
  - Gateway address
- Reserved address (in case the Ethernet extension needs to be constantly connected to a client)
- Timeout period

T

12.2.3 Data exchange

The Ethernet extension can exchange 16 data words, 4 clock words and one status word with the Modbus TCP/IP client.

This extension supports four Modbus functions: Read multiple registers, Write single register, Write multiple registers, and Read device identification.

For additional information please refer to the M3 Software Help files and to the installation sheet for this extension module.

12.3 Modem Communications

The M3MOD module can be used to interface the Millenium with 2 types of modems: Landline (PSTN) and GSM modems.

Depending on the type of modem used you have the following functions:

- Send alarms/receive instructions from cell phone
- Send alarms/receive instructions from PC running “M3 Alarm” software

- Transfer program, Update firmware, or go into Monitoring mode
- Send alarm to e-mail address

For additional information please refer to the M3 Software Help files and to the installation sheet for the M3MOD module.

13 Example of an FBD Application

This example describes how a greenhouse's window panes can be managed automatically.

13.1 Specifications

The owner of a greenhouse would like to automate the opening and closing of the ventilation window panes located on the greenhouse roof.

The greenhouse has two window panes to provide ventilation. The opening of these window panes is controlled by a motor and by 2 sensors that indicate whether the window panes are open or closed:

During the day, the window panes open to ventilate the structure from 12:00 to 15:00, at the time of day when, in principle, the temperature is the highest. However, if the temperature is less than 10ºC, he window panes do not open, or when they are already open, they close.

In addition, the window panes open during the day when the temperature reaches 25ºC. If the temperature falls below 25 ºC, the window panes must close again.

Finally, at night, the window panes remain closed regardless of the temperature.

13.2 Program description

3 time ranges are used:

- Range 1: Night, from 21:00 to 07:00
- Range 2: Day, from 07:00 to 12:00 and from 15:00 to 21:00
- Range 3: Noon, from 12:00 to 15:00

13.3 Summary

Input/Output Tables

Description of the inputs:

Input	Description
I1	Window Panes Open (Discrete)
I2	Window Panes Closed (Discrete)
IB	Temperature (Analog)

Description of the outputs:

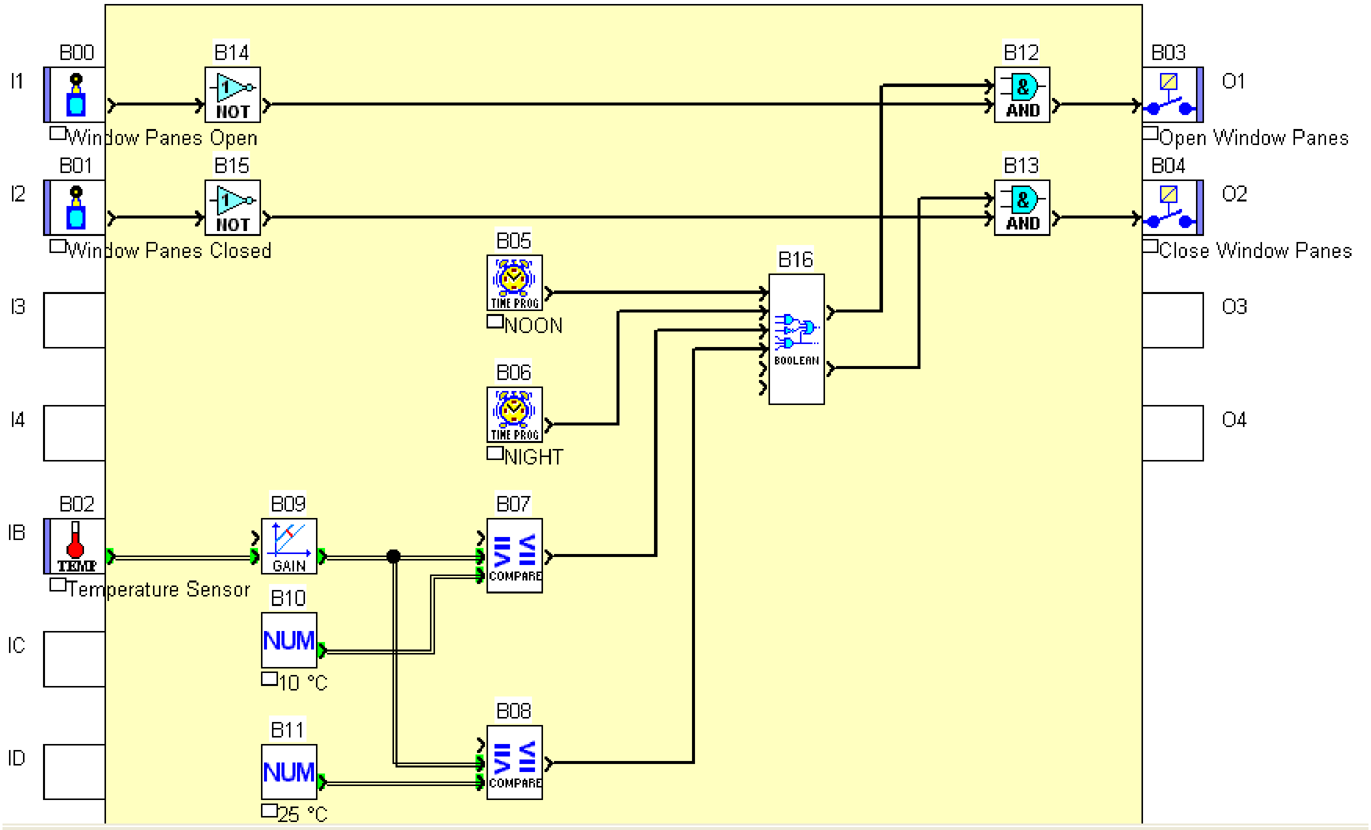
Input	Description
O1	Opening of the Window panes (Discrete)
O2	Closing of the Window panes (Discrete)

Model required:

For this application a controller with analog inputs is required so a DC powered controller will be selected. For this example we choose a CD12 Smart 24VDC, Solid State Ouput (P/N **88 974 042**).

GREENHOUSE.pm3

FBD wiring sheet:



Description of the Parameters:

Daily Programmer B05

Cycle in progress: 00

Hour: 12, Minute: 0
Output: ON
Weekly and Daily are checked

Cycle in progress: 01

Hour: 15, Minute: 0
Output: OFF
Weekly and Daily are checked

Daily Programmer B06

Cycle in progress: 00

Hour: 21, Minute: 0
Output: ON
Weekly and Daily are checked

Cycle in progress: 01

Hour: 7, Minute: 0
Output: OFF
Weekly and Daily are checked

Analog comparator B07

Value 1 < Value 2

Analog comparator B08

Value 1 >= Value 2

GAIN Block B09

A = 1500, B = 1023, C = -100
Range: -32768 to 32767

Boolean Function B16

Truth Table:

Noon	Night	<10°C	>25°C	Open	Close
B05	B07	B06	B08	O1	O2
0	0	0	0	0	1
1	0	0	0	1	0
0	1	0	0	0	1
1	1	0	0	0	0
0	0	1	0	0	1
1	0	1	0	0	1
0	1	1	0	0	1
1	1	1	0	0	0
0	0	0	1	1	0
1	0	0	1	1	0
0	1	0	1	0	1
1	1	0	1	0	0
0	0	1	1	0	0
1	0	1	1	0	0
0	1	1	1	0	0
1	1	1	1	0	0

NOTE: What is grayed out are combinations that will never occur on the actual application.

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