



GEMO® Ladder Editor V2.4

User's Manual

Rev. A

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1 Introduction

GEMO Ladder Editor is a ladder logic editor/simulator used to write/draw ladder diagrams/programs for GEMO Smart Relays/ PLC. User can test his/her ladder diagrams by using simulation feature. User can download a diagram/program to the smart relay by using communication cable via an RS-232 port.

This document does not instruct techniques related to writing/drawing ladder diagrams. This document is prepared as a reference document for GEMO Ladder Editor. The user/reader is assumed to have background about ladder diagrams.

Please help us to improve our software. We appreciate if you send your comments, feedbacks and bug reports (info@gemo.com.tr).

Please visit periodically www.gemo.com.tr for software/documentation updates.

The file extension of GEMO Ladder Editor's work file is ".ldr". GEMO Ladder Editor does associate ".ldr" files to itself automatically. If you wish, use Windows Explorer program to associate ".ldr" files to GEMO Ladder Editor manually. If you do so, you can directly open a file with extension ".ldr" into GEMO Ladder Editor by double clicking on its name or icon from a file browser.



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This software is developed with Borland® Delphi™ 2005.

2 What's New

2.1 What's new in Ver 2.4 Rev A

- AR2 series PLC/Smart Relay devices (except AR2-A-XXX-8D-XXX series) now may take place in an RS-485 MODBUS RTU network as a slave via the dedicated MODBUS gateway; AR2-S-24VDC-MB1.
- “NetIn” contacts are added.
- The “MODBUS Settings” screen added for adjusting MODBUS network settings and “NetIn” contact attributes.
- Printout function is added for "NetIn" contacts.
- Simulation function is added for "NetIn" contacts.
- The system contact named "ErrCommMbus" is added.
- “COM20” and “COM21” are added to com port selection list.
- Appropriate setting screen now appears immediately after a double click to a contact or to a coil drawn in a ladder diagram.
- Cosmetic clean up is performed in the editor layout in order to obtain a better appearance during when the GEMO Ladder Editor is run in a Linux environment using Wine emulator.

2.2 What's new in Ver 2.3 Rev C

AR2-A-8D series devices are added to AR2 family. GEMO Ladder Editor Ver 2.3 Rev C recognizes the following devices;

- AR2-A-24VDC-8D
- AR2-A-24VDC-8D-RTC
- AR2-A-230VAC-8D
- AR2-A-230VAC-8D-RTC

2.3 What's new in Ver 2.3 Rev B

AR2-P series devices are added to AR2 family. GEMO Ladder Editor Ver 2.3 Rev B recognizes the following devices;

- AR2-P-24VDC-10D2A
- AR2-P-24VDC-10D2A-RTC
- AR2-P-230VAC-10D2A
- AR2-P-230VAC-10D2A-RTC

2.4 What's new in Ver 2.3 Rev A

- “Find Contact” function is added to the editor.
- “Find Coil” function is added to the editor.
- “Check device type/version” function is added to the editor.
- “Reset (Reboot) Device” function is added to the editor.
- “Select Communication Speed” function and faster downloading function is added to the editor. Now download speed may be approximately 3 times faster.
- “GEMO AR2; 4..20mA -> 0..10V Conversion Calculator” is embedded in the editor.
- “Save as Ver 2.2” function is added in Ver 2.3.
- Configuration Contacts are added.
- Printout function is added for Configuration Contacts.
- Configuration Contacts are added in Menu Designer.
- Offset function is added for Analog and PTC inputs.
- Offsets for Analog and PTC inputs are added in Menu Designer.
- Password Contacts are added.
- Password Contacts are added in Menu Designer.
- Printout function is added for Password Contacts.
- Run Time Clock is added.
- Runtime Screens are updated to print “time” and “date” on LCD.
- Current time and date shall be altered via LCD with SET3; password = FFF1.
- Weekly Alarms (RTCWA) are added.
- Printout function is added for Weekly Alarms.
- Weekly Alarms shall be altered via LCD with SET3; password = FFF8.
- Yearly Alarms (RTCWA) are added.
- Printout function is added for Yearly Alarms.
- Yearly Alarms shall be altered via LCD with SET3; password = FFF9.
- “ErrRTC” (RTC error) is added to System Contacts.
- Automatic European Summer/Winter time update function is added.
- Simulation is updated for Password, Configuration, Weekly Alarm and Yearly Alarm Contacts, and Runtime Screens (time and date display).

2.5 What's new in Ver 2.2 Rev A

- With Ver 2.2, AR2-A and AR2-S can communicate with extension module AR2-G1 via network interface RS-485.
- 2 system contacts are added related to AR2-G1 extension module; ErrCommG1 and ErrCommAny.

2.6 What's new in Ver 2.1 Rev A

- Ver 2.1 now programs AR2 series devices.
- Ver 2.1 reads files prepared with Ver 1.1, loads only Language A'n items.
- Number of ladder lines increased to 256
- Printing is added.
- Rising Edge / Falling Edge added for all contacts.
- "Inverter" contact is added.
- Number of Discrete Inputs is 28.
- Filtered Discrete Inputs added
- Number of Discrete Outputs is 20.
- Number of Auxiliary Contacts is 48. Retention is added.
- Number of Timers is 32. Min. Max. Limit and Retention is added for each Timer. Each timer, now, can count hour, and may be used as an event counter (may count Timer Ticks and Fast Counter Ticks).
- Timer Ticks added.
- Number of Counters is 32. Min. Max. Limit and Retention is added for each counter. Maximum range is now 65535.
- Counter Comparators are added
- Fast Counters are added.
- State Machines are added.
- Front Panel F Keys are added.
- Filtered Front Panel F Keys are added.
- Analog Inputs and PTC temperature sensor inputs are added.
- Analog Comparators are added.
- System Contacts are added.
- Menu design is now 3 levels. Each level may contain up to 32 parameters. Password and parameter row/column selection are added.
- Run Time Screens are added.

- Welcome Screen is added.
- Backlight of LCD is now under user control.
- Upload of a previously downloaded with password protection is added.
- Simulation is updated for newly added and updated ladder components.
LCD simulation is added
- Retention is added.

2.7 Abbreviation

- DIn : Discrete Input
- DInFlt : Filtered Discrete Input
- DQ : Discrete Output
- Aux : Auxiliary Relay
- Tmr : Timer
- Cnt : Counter
- FstCnt : Fast Input Counter
- CntCmp : Counter Comparator
- CntCmpPrst : Counter Comparator Preset value
- Scr : Run Time Screen
- SmA : State Machine A
- SmB : State Machine B
- SmAIn : State Machine A Input
- SmBIn : State Machine B Input
- SmAQ : State Machine A Output
- SmBQ : State Machine B Output
- SmARst : State Machine A Reset Input
- SmAJmp : State Machine A Jump Input
- SmAInt : State Machine A Interrupt Input
- SmAEn : State Machine A Enable Input
- SmBRst : State Machine B Reset Input
- SmBJmp : State Machine B Jump Input
- SmBInt : State Machine B Interrupt Input
- SmBEn : State Machine B Enable Input

- Key : Front Panel F Key
- KeyFlt : Filtered Front Panel F Key
- Sys : System Contact
- An10VIn : 0-10V Analog Input
- TmrTick : Timer Tick
- AnCmp : Analog Comparator
- AnCmpPrst : Analog Comparator Preset value
- AnCmpHys : Analog Comparator Hysteresis value
- PTC : PTC Temperature Sensor (Input)
- RTC : Real Time Clock
- PowerONRst: Power On Reset pulse
- ErrRetention : Error Retention (non-volatile memory error)
- ErrPTC1 : Error PTC1 (PTC at CPU fails)
- ErrPTC2 : Error PTC2 (PTC at Extension module fails)
- ErrCommAny: Error Communication Any (There exists a communication problem with at least one of the extension modules).
- ErrCommG1 : Error Communication G1 (There exists a communication problem with AR2-G1 extension module).
- ErrRTC : Error Real Time Clock error
- CfgFlg : Configuration Contact.
- Pswd : Password Contact.
- RTCWA : Real Time Clock Weekly Alarm Contact.
- RTCYA : Real Time Clock Yearly Alarm Contact.
- ErrCommMbus : Error Communication with MB1 (There exists a communication problem with AR2-S-24VDC-MB1 MODBUS module).
- NetIn : MODBUS Network Coil

3 Device Input Output Configurations

3.1 AR2-A (8D Series)

Front panel with LCD module and F1, F2, F3 keys;

- **Inputs**
 - 8 x Digital Inputs (DIn1 ... DIn8), and PTC1. DIn9, DIn10, DIn11, DIn12, DIn13 and DIn14 are always OFF.
- **Output**
 - 5 x Digital Outputs (DQ1 ... DQ5); DQ6, DQ7, DQ8, DQ9 and DQ10 are not available.

3.2 AR2-P

Front panel with LCD module and F1, F2, F3 keys;

- **Inputs**
 - 10 x Digital Inputs (DIn1 ... DIn10), 2 x 0-10V Analog Inputs (AnIn1, AnIn2), PTC1. DIn11, DIn12, DIn13 and DIn14 are always OFF.
- **Output**
 - 7 x Digital Outputs (DQ1 ... DQ7); DQ8, DQ9 and DQ10 are not available.

3.3 AR2-A (12D2A and 14D Series)

Front panel with LCD module and F1, F2, F3 keys;

- **Inputs**
 - **Configuration 1:** 14 x Digital Inputs (DIn1 ... DIn14), PTC1
 - **Configuration 2:** 12 x Digital Inputs (DIn1 ... DIn12), 2 x 0-10V Analog Inputs (AnIn1, AnIn2), PTC1. At this configuration DIn13 and DIn14 are always OFF.
- **Output**
 - **Configuration 1:** 10 x Digital Outputs (DQ1 ... DQ10)

3.4 AR2-S

Front panel with LED's for I/O status;

- **Inputs**
 - **Configuration 1:** 14 x Digital Inputs (DIn1 ... DIn14), PTC1

- **Configuration 2:** 12 x Digital Inputs (DIn1 ... DIn12), 2 x 0-10V Analog Inputs (AnIn1, AnIn2), PTC1. At this configuration DIn13 and DIn14 are always OFF.
- **Output**
 - **Configuration 1:** 10 x Digital Outputs (DQ1 ... DQ10)

3.5 AR2-G1

Front panel with LED's for I/O status;

- **Inputs**
 - **Configuration 1:** 14 x Digital Inputs (DIn15 ... DIn28), PTC2
 - **Configuration 2:** 12 x Digital Inputs (DIn15 ... DIn26), 2 x 0-10V Analog Inputs (AnIn3, AnIn4), PTC2. At this configuration DIn27 and DIn28 are always OFF.
- **Output**
 - **Configuration 1:** 10 x Digital Outputs (DQ11 ... DQ20)

4 Some Issues that Require User Attention

In your applications, always use separate and independent mechanical and/or electromechanical devices/apparatus to support AR2 against emergency cases

4.1 Retention Feature

Some of ladder components have **retention feature**.

This feature may be enabled on purpose by the user.



Device senses power failure and saves status of retentive components to non volatile memory. Components which are set to be retentive resume their last status after power is on with the last status saved in the non volatile memory, and continues to operate with this resumed status. Status is output/input states and actual values, like the counting value of a counter.

The status of retentive components, duration of a power failure and the time when power will be on again may not be well known all the time. This uncertainty may lead to **undesired** or even **dangerous** starting positions/conditions for an application.

Use retention feature carefully. Study all conditions that may happen during/after a power failure and/or during/after power is on and take precautions.

Use;

- **Timers:** GATE and RESET inputs,
- **Counter:** RESET inputs,
- **Auxiliary Relays:** RESET inputs,
- **State Machines A/B:** RESET and ENABLE inputs,

to take precautions.

Starting an application with a user approval, i.e. user presses to a switch to resume or another switch to cancel or stop or restart from another point, will be an appropriate design approach.

If for some reason, any non volatile memory read/write error occurs for retention information, system contact **ErrRetention** becomes ON after power is on. In this case, retentive components are initialized as if they are not retentive.

4.2 Power on Status of Ladder Components

Device initializes and tests its hardware for the first 3 seconds after power is on. Scanning starts after test and initialization.

Power on status of Ladder Components (except the retentive ones);

- **Digital Inputs:** same as Device inputs,
- **Filtered Digital Inputs:** depends on the filter time and device input,

- **Digital Outputs:** all OFF,
- **Auxiliary Relays:** all OFF,
- **Timers:** all with RESET input is pulsed before scan,
- **Counters:** all with RESET input is pulsed before scan,
- **Fast Input Counters:** all OFF, loaded with Presets
- **Counter Comparators:** all OFF,
- **State Machines:** starts from State 1, with all outputs OFF,
- **Front Panel F Keys:** same as front panel F keys,
- **Filtered Front Panel F Keys:** depends on filter time and front panel F key status,
- **Timer Ticks:** all OFF,
- **Run Time Screens:** all OFF,
- **Analog Comparators:** all OFF,
- **NetIn Coils:** all OFF,
- **System Flags (Contacts):**
 - **PowerONRst:** 0.5 seconds ON then OFF,
 - **ErrRetention:** ON if non volatile memory read error, else OFF,
 - **ErrPTC1:** depends on sensor,
 - **ErrPTC2:** depends on sensor,
 - **ErrCommAny:** OFF,
 - **ErrCommG1:** OFF
 - **ErrCommMbus:** OFF



4.3 Rising Edge / Falling Edge Generation after Power on

Rising Edge / Falling Edge generation is inhibited while **PowerONRst** is ON (the first 0.5 sec. after scanning starts). After that, Rising Edge / Falling Edge generation is enabled.

Starting an application with a user approval after power on, i.e. user presses to a switch to start, will be an appropriate design approach.

4.4 Input Edge Detection of Ladder Components after Power on

Input edge detection of ladder components is not allowed during the first scan cycle after Power is on. For example, a counter does not count when a rising edge exists at its "Count" input during the first scan cycle, but it counts at the next cycles.

4.5 Fast Input Counters

Be sure that Preset value of a Fast Input Counter is high enough. Refer to Fast Input Counters section.

4.6 Weekly and Yearly Alarms

Weekly Alarms (RTCWA) and Yearly Alarms (RTCYA) may be ON just after power is on, depending on the user settings.

Use RTCWA and RTCYA features carefully. Study all conditions that may happen during/after a power failure and/or during/after power is on and take precautions.

4.7 Ladder Diagram Warnings

If there exists any warning(s) about a ladder diagram/program, a red button appears on the left top corner of the diagram. Press the red button to read the warnings. It is advised to have no warning for every diagram/program before simulation or downloading.

4.8 Analog Ground and Analog Power Supply

Devices having analog inputs have separate Analog Ground. Do not use 18V Auxiliary supply out of device to power the external analog circuitry/device(s) that generate 10Vdc analog signal. Analog ground is isolated than Discrete Input signal return path.

Use a separate power supply to power the external analog circuitry/device(s) that generate 10Vdc analog signal. This supply should be double insulated. Do not use this supply to power any other device or circuitry. Prefer to use a regulated power supply.

Connect Analog Ground to the external analog circuitry/device(s) that generate 10Vdc analog signal with a separate cable. Use twisted pair cable with a shield and connect shield to earth only from the device side, leave other side unconnected.

4.9 RS-485 Connection

Use shielded twisted pair cable for RS-485 connection. For correct line termination please refer to related application note; www.gemo.com.tr.

4.10 Mounting and Environmental Conditions

- Mount the device in a ventilated place, and be sure that air inlets are not blocked. Use mounting holes to fasten or install on a rail.
- Take precautions against environmental conditions like humidity, vibration, pollution and high/low temperature during installation.
- Do not use device out of its technical specifications.
- Keep device away from circuit breaker, devices/cables emitting electrical noise, power cables.



- Keep signal and communication cables away from circuit breaker, devices/cables emitting electrical noise, power cables.
- Use shielded and twisted signal and communication cables and connect shield to ground on device side.
- Use an appropriate fuse on mains/supply input of the device. Use appropriate cables for mains connections. Apply safety regulations during installation.

4.11 Opening a Ladder File from File Browser

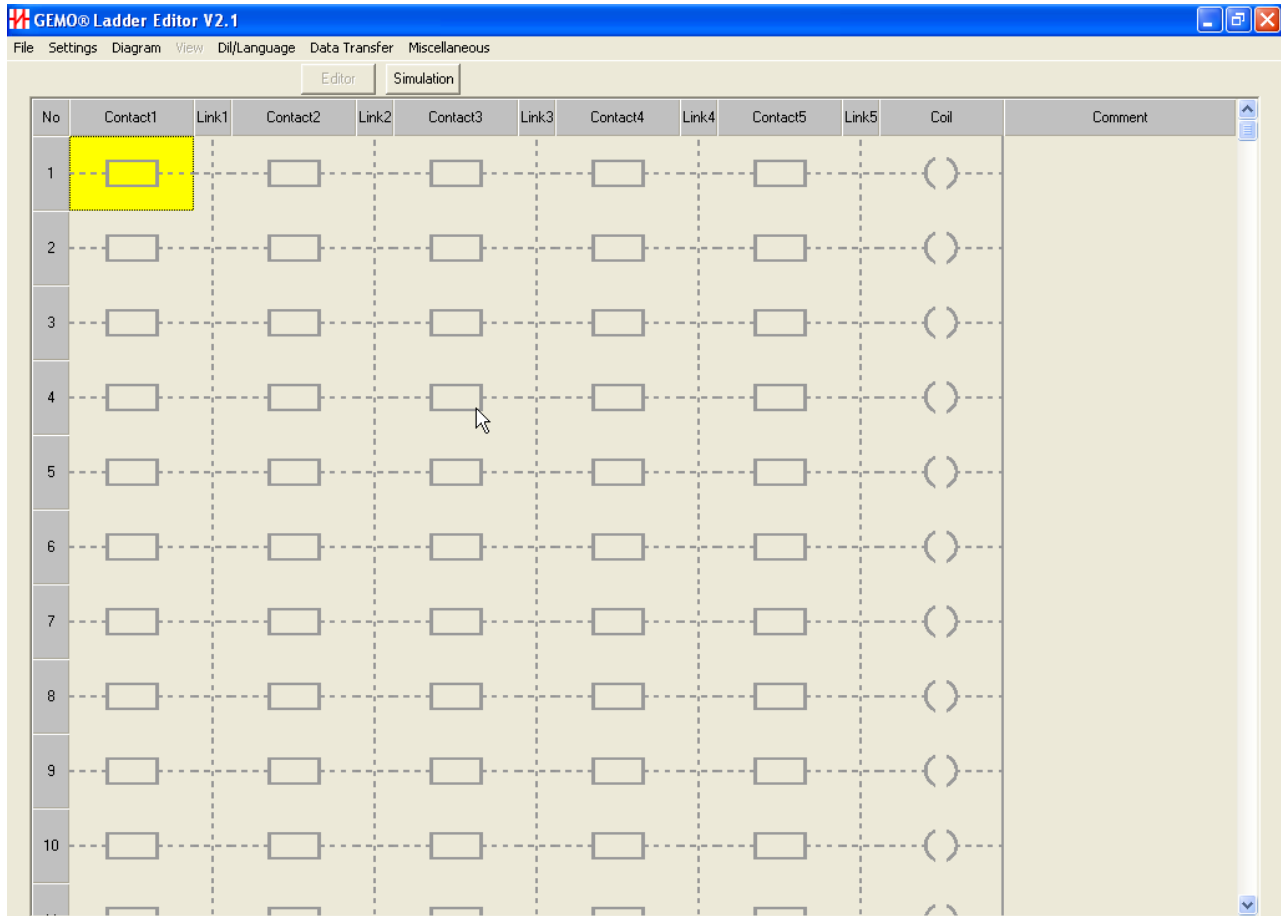
The file extension of GEMO Ladder Editor's work file is ".ldr". GEMO Ladder Editor does associate ".ldr" files to itself automatically. If you wish, use Windows Explorer program to associate ".ldr" files to GEMO Ladder Editor manually. If you do so, you can directly open a file with extension ".ldr" into GEMO Ladder Editor by double clicking on its name or icon from a file browser.



5 Ladder Editor

5.1 Main Screen

Main screen is seen after the application starts. Main screen is composed of; main menu, Editor & Simulation Buttons, 5 Contact columns, 5 Link columns, Coil column and Comment Column.



5.1.1 Main Menu

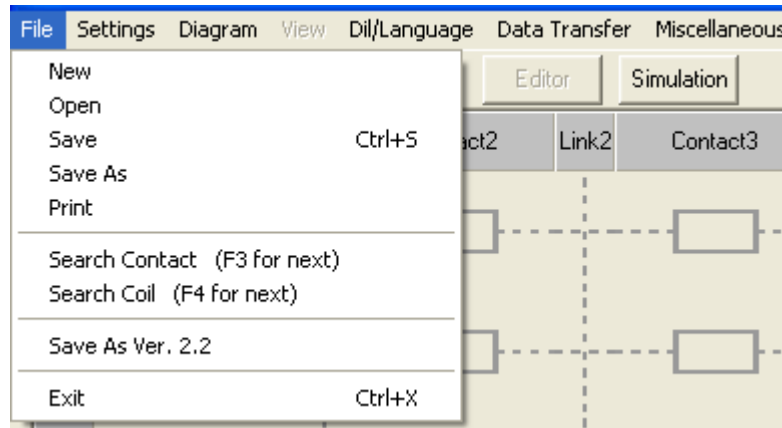
Main menu is composed of the following sub menu items.

5.1.1.1 File

File sub menu item is composed of the following sub menu items;

- **New** : Starts a new/empty diagram
- **Open** : Opens a previously saved diagram
- **Save** : Saves current/open diagram
- **Save as** : Saves current/open diagram with a new/different name
- **Print** : Opens print dialog.

- **Search Contact** : Use to search a specific contact in the diagram. Use F3 for the next one.
- **Search Coil** : Use to search a specific coil in the diagram. Use F4 for the next one.
- **Save As Ver2.2** : Use to save file in Ver2.2. format
- **Exit** : Ends application

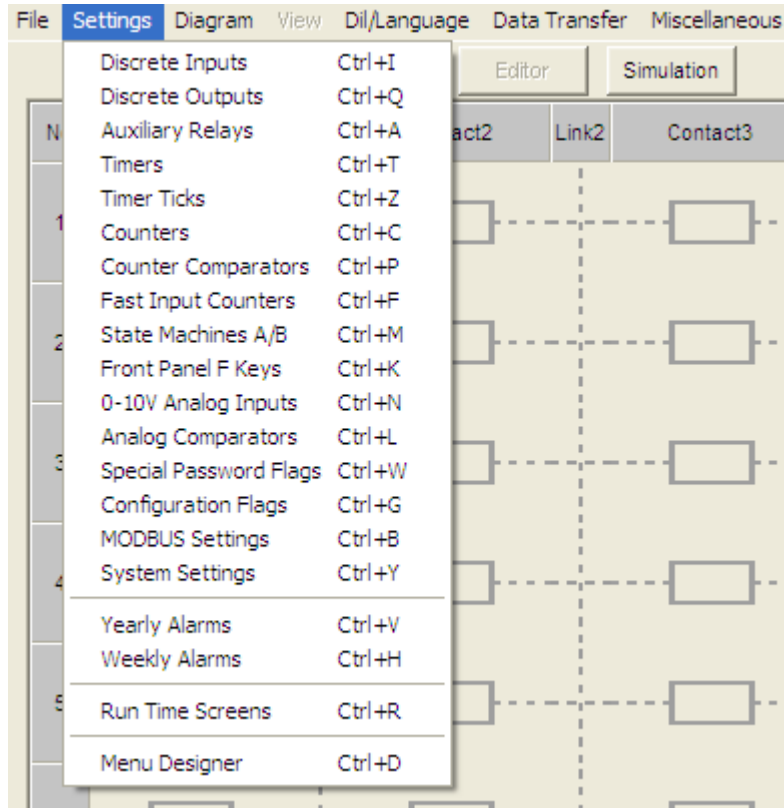


5.1.1.2 Settings

Settings sub menu item is composed of the following sub menu items.

- **Discrete Inputs** : Opens Discrete Inputs sub screen.
- **Discrete Outputs** : Opens Discrete Outputs sub screen.
- **Auxiliary Relays** : Opens Auxiliary Relays sub screen.
- **Timers** : Opens Timers sub screen.
- **Timer Ticks** : Opens Timer Ticks sub screen.
- **Counters** : Opens Counters sub screen.
- **Counter Comparators** : Opens Counter Comparators sub screen.
- **Fast Input Counters** : Opens Fast Input Counters sub screen.
- **State Machines A/B** : Opens State Machines sub screen.
- **Front Panel F Keys** : Opens Front Panel F Keys sub screen.
- **0-10V Analog Inputs** : Opens 0-10V Analog Inputs sub screen.
- **Analog Comparators** : Opens Analog Comparators sub screen.
- **Special Password Flags** : Opens Special Password Flags sub screen.
- **Configuration Flags** : Opens Configuration Flags sub screen.
- **MODBUS Setting** : Opens MODBUS Setting sub screen.

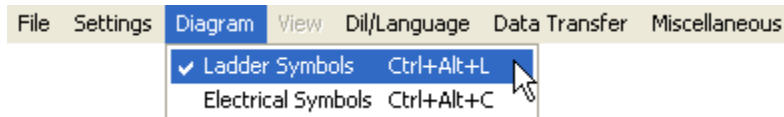
- **System Settings** : Opens System Settings sub screen.
- **Yearly Alarms** : Opens Yearly Alarms sub screen.
- **Weekly Alarms** : Opens Weekly Alarms sub screen.
- **Run Time Screens** : Opens Run Time Screens sub screen.
- **Menu Designer** : Opens LCD Menu Designer sub screen.



5.1.1.3 Diagram

Diagram sub menu item is composed of the following sub menu items.

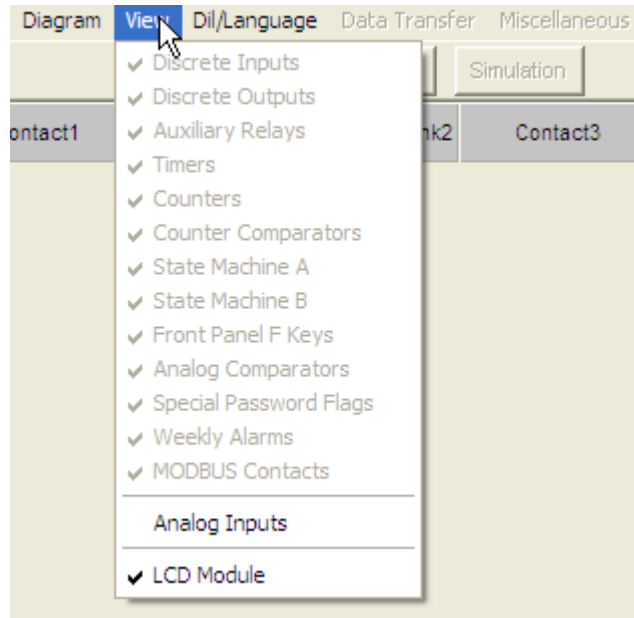
- **Ladder Symbols** : Diagram is drawn with ladder symbols.
- **Electrical Symbols** : Diagram is drawn with electrical symbols.



5.1.1.4 View

This sub menu is active in simulation mode. User selects show/hide of relevant simulation sub screens via this sub menu.

- **Discrete Inputs** : Show / Hide
- **Discrete Outputs** : Show / Hide
- **Auxiliary Relays** : Show / Hide
- **Timers** : Show / Hide
- **Counters** : Show / Hide
- **Counter Comparators** : Show / Hide
- **State Machine A** : Show / Hide
- **State Machine B** : Show / Hide
- **Front Panel F Keys** : Show / Hide
- **Analog Comparators** : Show / Hide
- **Special Password Flags**: Show / Hide
- **Weekly Alarms** : Show / Hide
- **MODBUS Contacts** : Show / Hide
- **Analog Inputs** : Show / Hide
- **LCD Module** : Show / Hide



5.1.1.5 Dil / Language

Dil / Language sub menu item is composed of the following sub menu items.

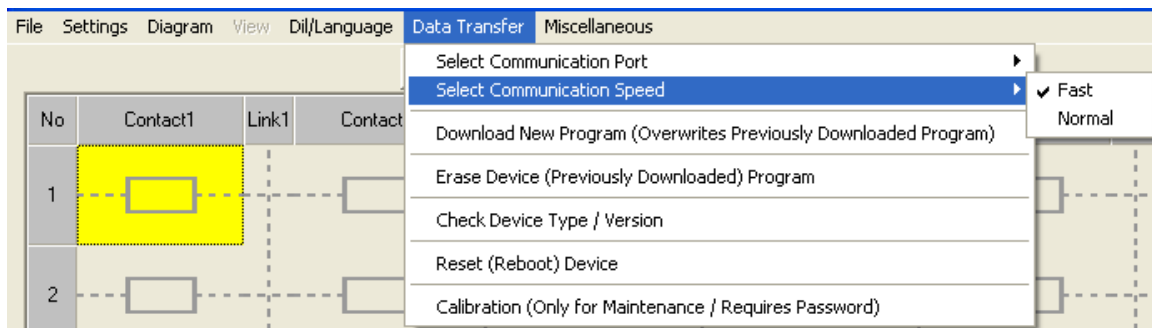
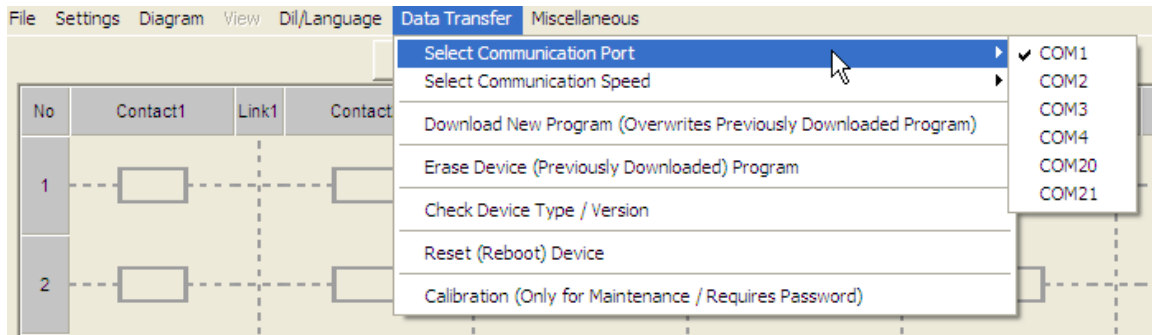
- **Türkçe** : Editor Language is Turkish.
- **English** : Editor Language is English.



5.1.1.6 Data Transfer

Data Transfer sub menu item is composed of the following sub menu items.

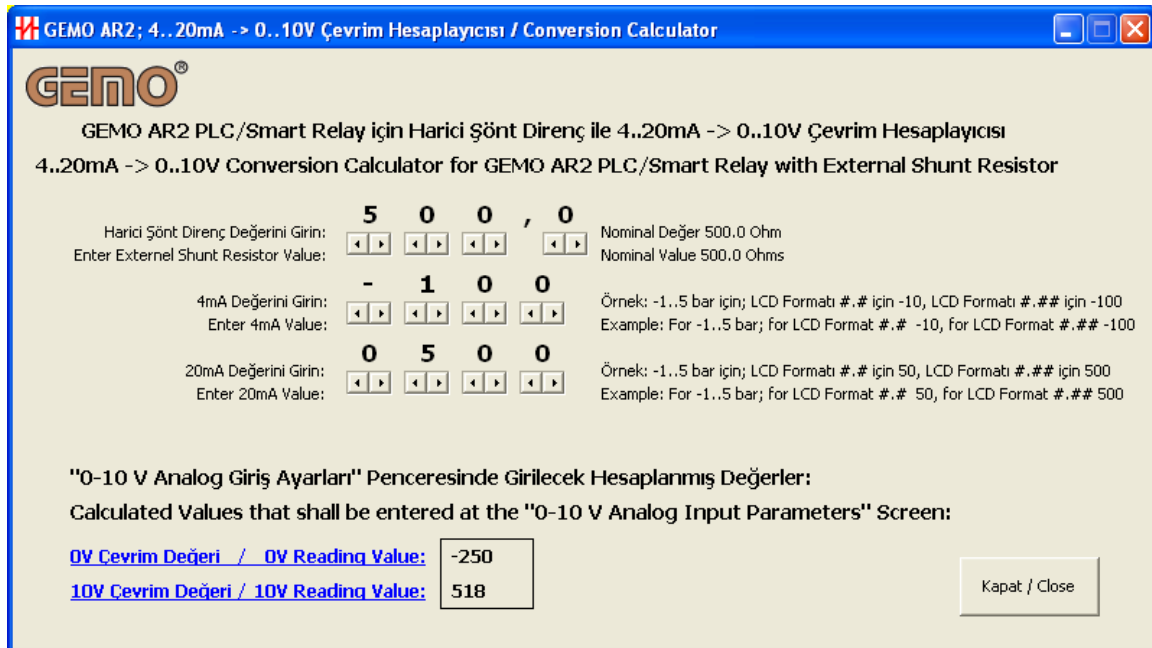
- **Select Communication Port** : Selects RS-232 port to download; COM1, COM2, COM3, COM4, COM20 or COM21.
- **Set Communication Speed** : Selects communication speed; Fast or normal. Fast is introduced with Ver2.3.
- **Download New Program** : Starts downloading current ladder diagram/program to Smart Relay. Previously stored diagram/program in smart relay is permanently replaced with the new one.
- **Erase Device Program** : Previously stored diagram/program in smart relay is permanently erased. User can download a new one any time later on.
- **Check Device Type/Version** : Used to check type and version of connected device.
- **Reset (Reboot) Device** : Used to soft-reset device.
- **Calibration** : Used after production or maintenance.



5.1.1.7 Miscellaneous

Miscellaneous sub menu item is composed of the following sub menu items.

- **About** : Displays information about editor.
- **Conversion Calculator**: Starts 4..20mA → 0..10 V Conversion Calculator for AR2.
- **Read License** : Displays license information



5.1.2 Editor Button

Press Editor Button to switch to editing mode while in simulation mode.

5.1.3 Simulation Button

Press Simulation Button to switch to simulation mode while in editing mode.

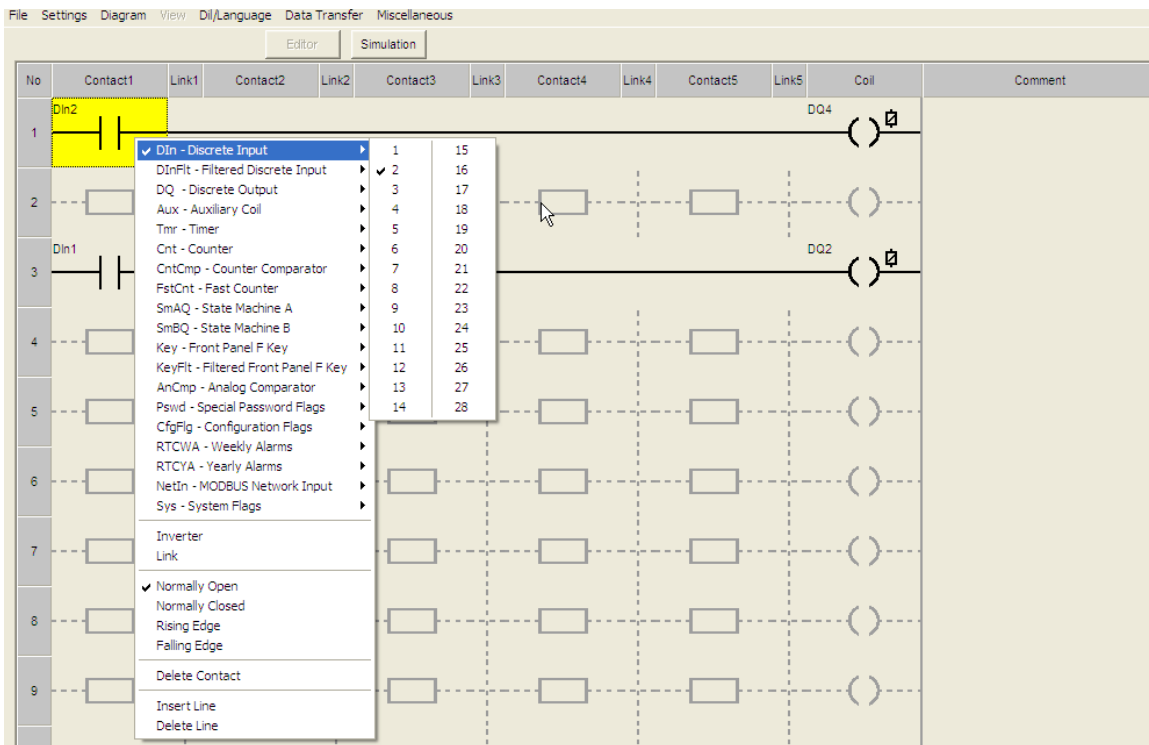
5.1.4 Contact Columns

There exist 5 contact columns in series. Press left button of mouse to select the desired contact. Press right button of mouse to view/alter the properties of

selected contact. Refer to Abbreviations section to review the representation of selected contacts.

- **Discrete Input:** Selected contact becomes discrete input. Input number is selected via sub menu.
- **Filtered Discrete Input:** Selected contact becomes filtered discrete input. Filtered input number is selected via sub menu.
- **Discrete Output:** Selected contact becomes discrete output. Output number is selected via sub menu.
- **Auxiliary Relay:** Selected contact becomes Auxiliary Relay. Auxiliary relay number is selected via sub menu.
- **Timer:** Selected contact becomes Timer. Timer number is selected via sub menu.
- **Counter:** Selected contact becomes a Counter. Counter number is selected via sub menu.
- **Counter Comparator:** Selected contact becomes Counter Comparator. Counter Comparator number is selected via sub menu.
- **Fast Input Counter:** Selected contact becomes Fast Input Counter. Fast Input Counter number is selected via sub menu.
- **State Machine A:** Selected contact becomes Output of State Machine A. Output number is selected via sub menu.
- **State Machine B:** Selected contact becomes Output of State Machine B. Output number is selected via sub menu.
- **Front Panel F Key:** Selected contact becomes Front Panel F Key. Key number is selected via sub menu.
- **Filtered Front Panel F Key:** Selected contact becomes Filtered Front Panel F Key. Key number is selected via sub menu.
- **Analog Comparator:** Selected contact becomes Analog Comparator. Analog Comparator number is selected via sub menu.
- **Special Password Flags:** Selected contact becomes Special Password Flag. Flag number is selected via sub menu.
- **Configuration Flags:** Selected contact becomes Configuration Flag. Flag number is selected via sub menu.
- **Weekly Alarms:** Selected contact becomes Weekly Alarm. Weekly Alarm number is selected via sub menu.
- **Yearly Alarms:** Selected contact becomes Yearly Alarm. Yearly Alarm number is selected via sub menu.

- **MODBUS Network Input:** Selected contact becomes MODBUS Network Input/Coil. MODBUS Network Input/Coil number is selected via sub menu.
- **System Flags:** Selected contact becomes one of the System Flags Contact. Flag type is selected via sub menu.
- **Inverter:** Selected contact becomes an inverting link (logical not).
- **Link:** Selected contact becomes a link (short circuit).
- **Normally Open:** Selected contact operates as a normally open contact.
- **Normally Closed:** Selected contact operates as a normally closed contact.
- **Rising Edge:** Selected contact operates as a rising edge contact.
- **Falling Edge:** Selected contact operates as a falling edge contact.
- **Delete Contact:** Selected contact is deleted.
- **Insert Line:** A new line is inserted before the selected contact's line. All lines slides downward and the last line is deleted.
- **Delete Line:** Selected contact's line is deleted. All lines slides upward and an empty line is inserted as the last line.



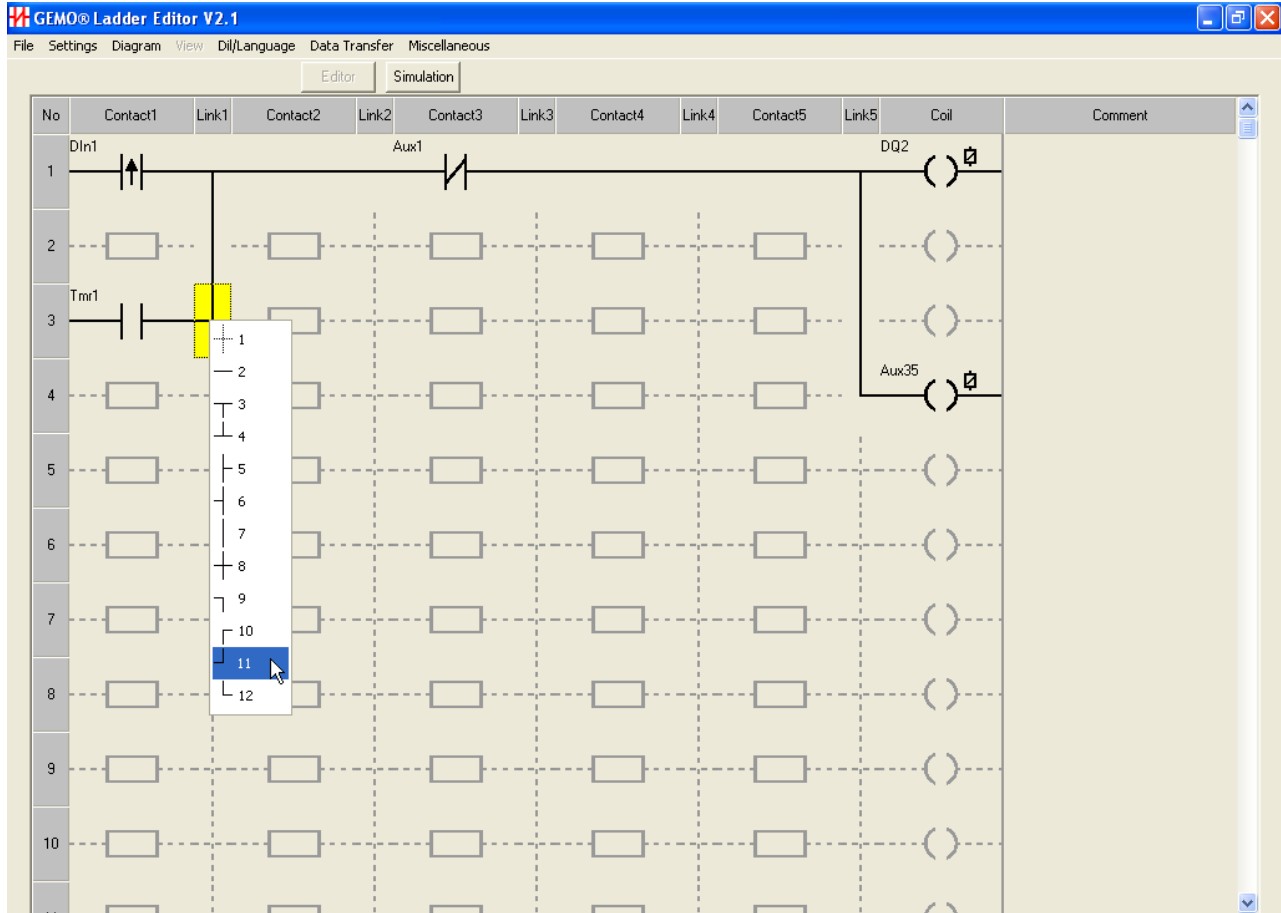
5.1.5 Link Columns

There exist 5 link columns in series.

Contacts and coils are connected each other by means of links. A link may have upper, lower, left and right connections.

Press left button of mouse to select a link. Press right button of mouse to see the list of possible connections and select the appropriate one or select the dashed one to delete the link.

Refer to “Fast Line Drawing” section for faster diagram drawing.



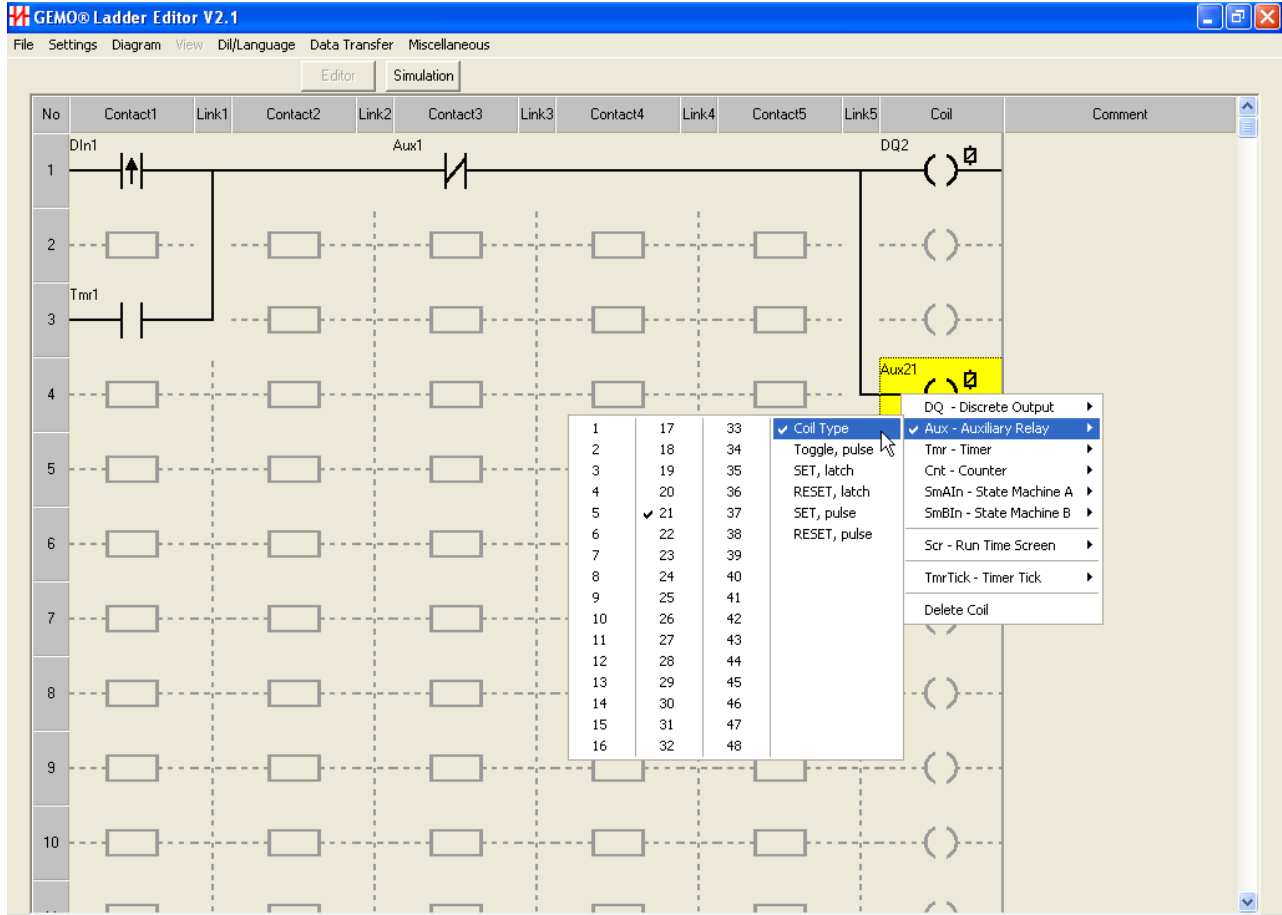
5.1.6 Coil Column

There exists 1 coil column.

Press left button of mouse to select a coil. Press right button of mouse to view/alter the properties of selected coil.

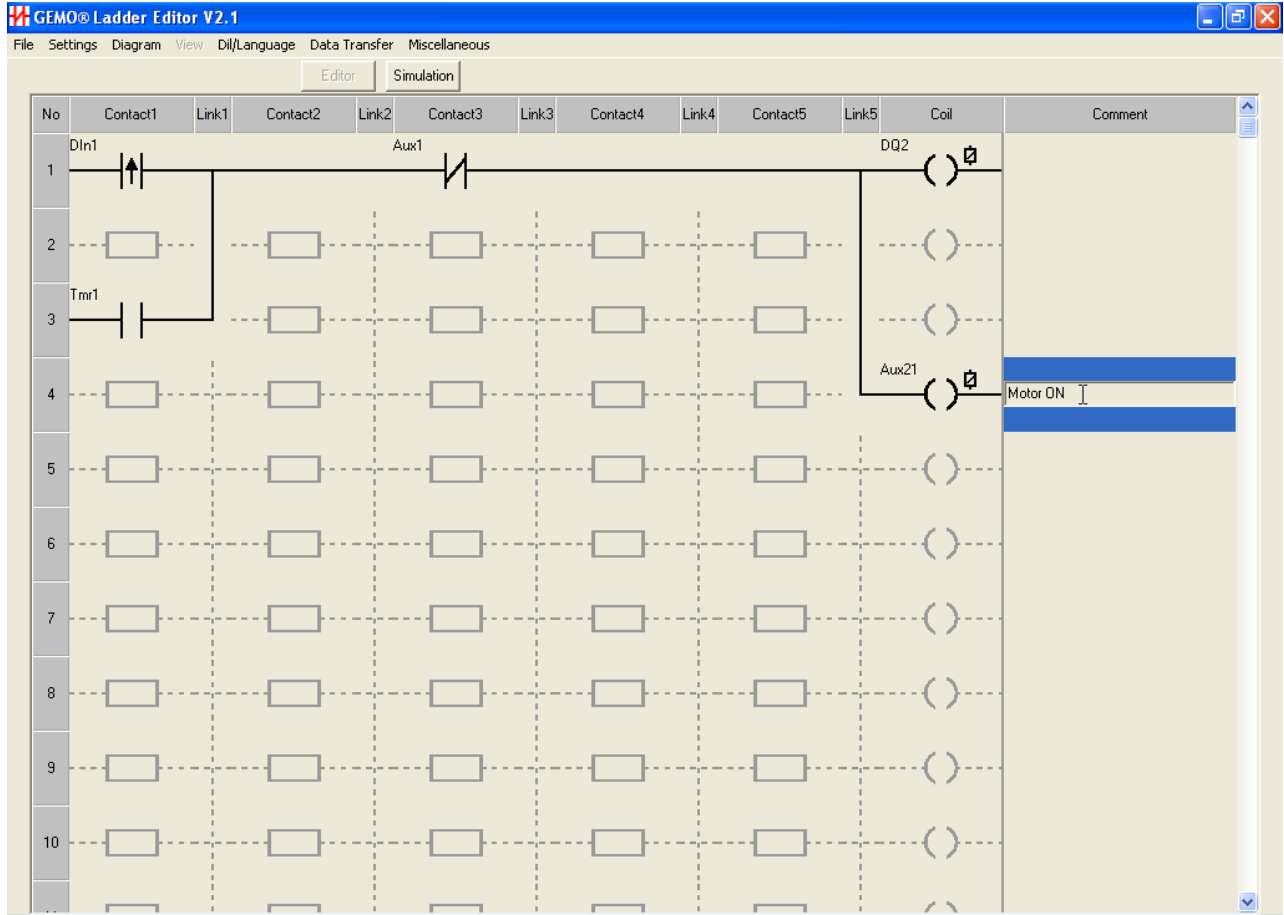
Refer to Abbreviations section to review the representation of selected coils.

- **Discrete Output:** Selected coil becomes an input of a Discrete Output. Discrete Output number and input type are selected via sub menu. Refer to “Ladder Components” for further information about input types.
- **Auxiliary Relay:** Selected coil becomes an input of an Auxiliary Relay. Auxiliary Relay number and input type are selected via sub menu. Refer to “Ladder Components” for further information about input types.
- **Timer:** Selected coil becomes an input of a Timer. Timer number and input type are selected via sub menu. Refer to “Ladder Components” for further information about input types.
- **Counter:** Selected coil becomes an input of a Counter. Counter number and input type are selected via sub menu. Refer to “Ladder Components” for further information about input types.
- **State Machine A:** Selected coil becomes an input of State Machine A. Input number or type is selected via sub menu. Refer to “Ladder Components” for further information about input types.
- **State Machine B:** Selected coil becomes an input of State Machine B. Input number or type is selected via sub menu. Refer to “Ladder Components” for further information about input types.
- **Run Time Screen:** Selected coil becomes an input of a Run Time Screen. Run Time Screen number and input type are selected via sub menu. Refer to “Ladder Components” for further information about input types.
- **Timer Tick:** Selected coil becomes a Timer Tick. Timer Tick number is selected via sub menu. Refer to “Ladder Components” for further information about Timer Ticks.
- **Delete Coil:** Selected coil is deleted.



5.1.7 Comment Column

User can write a comment for each ladder line. Double click left button of mouse to the comment section of a line to place a comment.



5.2 Simulation Screen

Press Simulation Button to switch to simulation mode while in editing mode. Test/simulate diagram in simulation mode.

Ladder components may be displayed as ladder symbols or electrical symbols. Symbols, links, contacts and coils are displayed in 3 colors; Red if ON or active, blue if OFF or passive, yellow if ready to be ON or active.

The status of ladder elements is seen on separate sub screens. For inputs; green is active, black is passive. For outputs; Red is active, black is passive.

The preset and actual values of appropriate ladder elements are red if active, blue if passive, black for Preset/Reset values and yellow if stand-by or paused.

The sub screen of a ladder element becomes automatically visible in simulation mode if it is already used in the diagram.

A sub screen is set to visible or hidden via “View” menu item.

Filtered inputs are represented with separate colored shapes on top of unfiltered ones. The color is green if active, black is passive, yellow if filter is active.

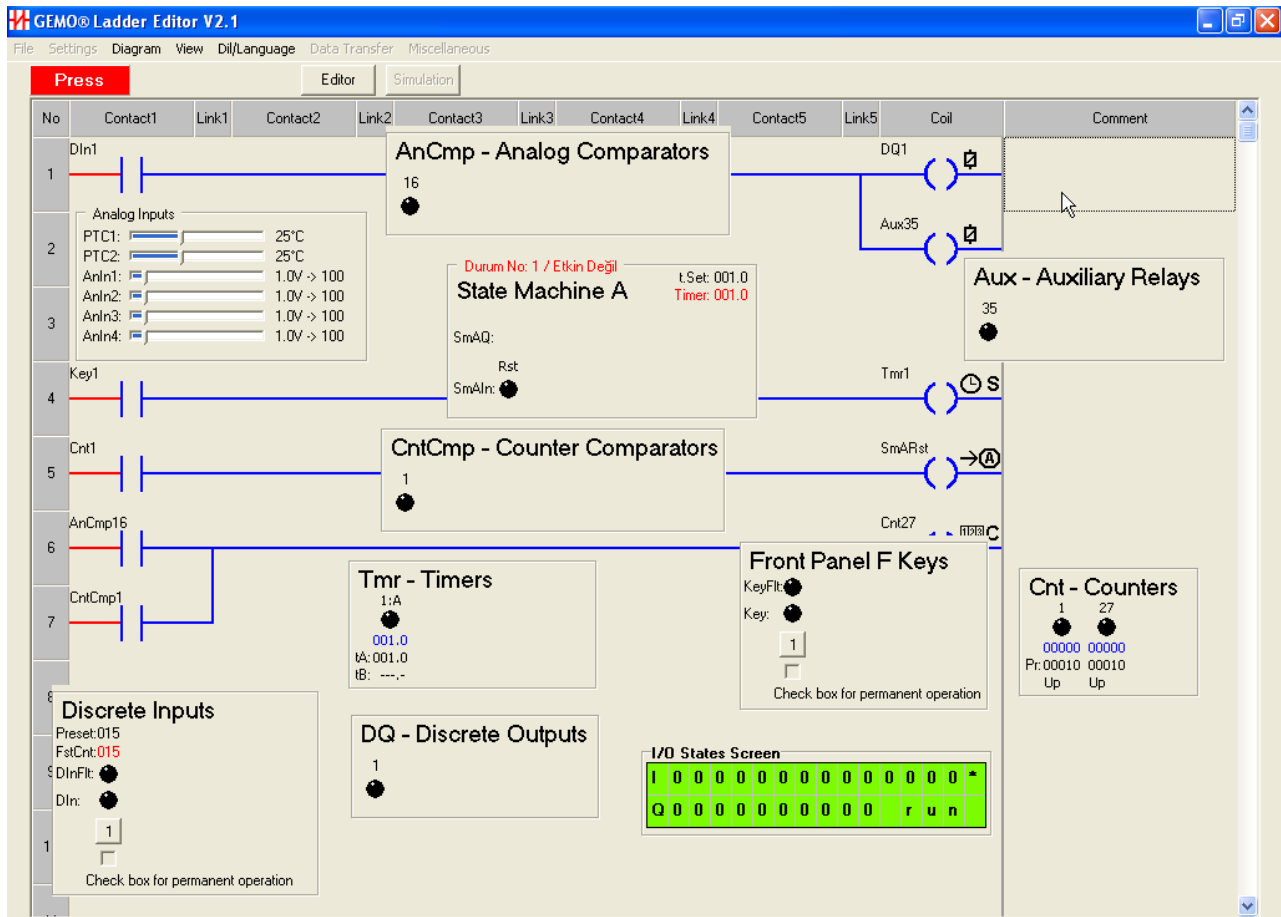
Fast Input Counters are seen / simulated in Discrete Input simulation sub screen.

Analog inputs and PTC temperature sensor inputs are simulated via a moving bar like a potentiometer. Analog signal value and transformed value are read on right side of each bar.

Run time screens are simulated via LCD Module simulation.

Any simulation sub screen may be relocated. Press left button of mouse to an empty point of a sub screen and move mouse while keeping button pressed.

If there exists any warning(s) about the ladder diagram/program, a red button appears on the left top corner of the diagram. Press the red button to read the warnings. It is advised to have no warning for every diagram/program before simulation or downloading.



5.3 Discrete Input Settings Screen

Press Settings->Discrete Inputs to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **FtON:** Filter ON time in seconds with a resolution of 1/100 second. Minimum filter time is 0 and maximum filter time is 2.5 seconds. Refer to Ladder Elements section about filtered inputs.
- **FtOFF:** Filter OFF time in seconds with a resolution of 1/100 second. Minimum filter time is 0 and maximum filter time is 2.5 seconds. Refer to Ladder Elements section about filtered inputs.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for selected Discrete Input contact.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Discrete Input Settings

No	FtON	FtOFF	Ladder Comment (LC)	LC	Comment
DIn1	0.00	0.00		No	
DIn2	0.00	0.00		No	
DIn3	0.00	0.00		No	
DIn4	1.00	2.00	Motor switch	Yes	Activate Motor
DIn5	0.00	0.00		No	
DIn6	0.00	0.00		No	
DIn7	0.00	0.00		No	
DIn8	0.00	0.00		No	
DIn9	0.00	0.00		No	
DIn10	0.00	0.00		No	
DIn11	0.00	0.00		No	
DIn12	0.00	0.00		No	
DIn13	0.00	0.00		No	
DIn14	0.00	0.00		No	
DIn15	0.00	0.00		No	
DIn16	0.00	0.00		No	
DIn17	0.00	0.00		No	
DIn18	0.00	0.00		No	

FtON: OFF->ON filter time (0 - 2.50 seconds)
FtOFF: ON->OFF filter time (0 - 2.50 seconds)

Done

5.4 Discrete Output Notes Screen

Press Settings->Discrete Outputs to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen.

Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Discrete Output.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Discrete Output Notes

Discrete Output Notes

No	Ladder Comment (LC)	LC	Comment
DQ1		No	
DQ2		No	
DQ3		No	
DQ4	Motor Relay	Yes	Use a high capacity relay
DQ5		No	
DQ6		No	
DQ7		No	
DQ8		No	
DQ9		No	
DQ10		No	
DQ11		No	
DQ12		No	
DQ13		No	
DQ14		No	
DQ15		No	
DQ16		No	
DQ17		No	

Done

5.5 Auxiliary Relay Settings Screen

Press Settings-> Auxiliary Relay to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Retentive:** Alter by double clicking; yes, no. If “yes”, selected Auxiliary Relay is retentive. Refer to ‘Retention’ section for more information.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Auxiliary Relay.

- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no” ladder, comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Auxiliary Relay Settings

Auxiliary Relay Settings

No	Retentive	Ladder Comment (LC)	LC	Comment
Aux1	No		No	
Aux2	No		No	
Aux3	No		No	
Aux4	No		No	
Aux5	No		No	
Aux6	Yes	Process started	Yes	should be reset at the end of process.
Aux7	No		No	
Aux8	No		No	
Aux9	No		No	
Aux10	No		No	
Aux11	No		No	
Aux12	No		No	
Aux13	No		No	
Aux14	No		No	
Aux15	No		No	
Aux16	No		No	
Aux17	No		No	

5.6 Timer Parameters Screen

Press Settings-> Timers to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Function:** Double click this cell to view a list of built in timer functions. Select a function for each timer. Selected timers function is illustrated on bottom of the screen. Also an explanation of the selected function is displayed next to the illustration. Refer to “Ladder Components” section for detailed description of each timer function.
- **Retentive:** Alter by double clicking; yes, no. If “yes”, selected Timer is retentive. Refer to ‘Retention’ section for more information.
- **tA:** Enter default Preset A value for each timer.

- **tB:** Enter default Preset B value for each timer. Preset B is not defined for some timer functions.
- **Unit:** Select resolution (time base) for each timer.
- **tA.Min.:** Enter minimum value for tA that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **tA.Max.:** Enter maximum value for tA that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **tB.Min.:** Enter minimum value for tB that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **tB.Max.:** Enter maximum value for tB that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Timer.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Timer Parameters

No	Function	Retentive	tA	tB	Unit	tA.Min.	tA.Max.	tB.Min.	tB.Max.	Ladder Comment (LC)	LC	Comment
Tmr1	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr2	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr3	B:Pulsed delay, OFF with RESET	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr4	C:Retriggerable one shot	Yes	230.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr5	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr6	J:Flashing with START/RESET	No	001.0	023.0	1/10 sec.	000.0	999.9	000.0	999.9	Alarm Lambası	Yes	Kırmızı Lamba
Tmr7	L:Independent ON delay, OFF delay	Yes	001.0	040.0	1/10 sec.	000.0	999.9	000.0	999.9		No	
Tmr8	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr9	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr10	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr11	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr12	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr13	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr14	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr15	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr16	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	
Tmr17	A:ON delay	No	001.0	...	1/10 sec.	000.0	999.9	...	...		No	

J:Flashing with START/RESET

Mode J: Tx is periodically first ON for "tA" and then OFF for "tB" after START input is triggered (OFF > ON). If "tB" is set to 0, then tB=tA (symmetrical ON/OFF). Tx is OFF when RESET input is ON.

tA.Min. <= tA <= tA.Max.
tB.Min. <= tB <= tB.Max.

Done

5.7 Timer Tick Notes Screen

Press Settings-> Timer Ticks to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Timer Tick.
- **LC:** Alter LC by double clicking; yes, no. If "yes", ladder comment is seen on ladder diagram, if "no", ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Timer Tick Notes

No	Ladder Comment (LC)	LC	Comment
TmrTick1	Measuring Pulse	Yes	Use only in SmA
TmrTick2		No	

The diagram shows a central rectangular block labeled "Timer". On the left side, there are eight input arrows pointing into the block, labeled from top to bottom: "1/100 sec.", "1/10 sec.", "1 sec.", "1 min.", "1 hour", "FstCnt1", "FstCnt2", "TmrTick1", and "TmrTick2". On the right side, there is one output arrow pointing out of the block, labeled "Tmr(x)".

Done

5.8 Counter Parameters Screen

Press Settings-> Counters to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Type:** Double click this cell to alter counter type; up, down. Counter operation is illustrated on bottom of the screen. Refer to "Ladder Components" section for detailed description of counter operation.
- **Retentive:** Alter by double clicking; yes, no. If "yes", selected Counter is retentive. Refer to 'Retention' section for more information.
- **Preset:** Enter default Preset value for each counter.
- **Min. SET:** Enter minimum value for Preset that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **Max. SET:** Enter maximum value for Preset that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.

- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Counter.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Counter Parameters

No	Type	Retentive	Preset	Min.SET	Max.SET	Ladder Comment (LC)	LC	Comment
Cnt1	Up	No	10	0	65535		No	
Cnt2	Down	No	10	0	65535		No	
Cnt3	Up	Yes	2543	456	56500	Piston	Yes	Do not use Reset Input
Cnt4	Up	No	10	0	65535		No	
Cnt5	Up	No	10	0	65535		No	
Cnt6	Up	No	10	0	65535		No	
Cnt7	Up	No	10	0	65535		No	
Cnt8	Up	No	10	0	65535		No	
Cnt9	Up	No	10	0	65535		No	
Cnt10	Up	No	10	0	65535		No	
Cnt11	Up	No	10	0	65535		No	
Cnt12	Up	No	10	0	65535		No	
Cnt13	Up	No	10	0	65535		No	
Cnt14	Up	No	10	0	65535		No	
Cnt15	Up	No	10	0	65535		No	
Cnt16	Up	No	10	0	65535		No	
Cnt17	Up	No	10	0	65535		No	

Up Counting Down Counting

65535
Preset
0
Reset
Direction
Output

Done

5.9 Counter Comparator Parameters Screen

Press Settings-> Counter Comparators to access this sub screen.

This screen is composed of 2 tabs. Press the relevant tab to access the Counter Comparator Table or Counter Comparator Preset Table.

5.9.1 Counter Comparator Table

Press Comparator Table tab in the Counter Comparator Parameters Screen to access Counter Comparator Table. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are

colored to maintain table more readable when cell value is other than the default value. Select one of the rows and read the exact form of comparison expression of the selected Counter Comparator below table in blue color.

- **Parameter A:** Double click this cell to view a list of Parameters and then click to select one as Parameter A.
- **Param. A No:** Double click this cell to view a numbers list for Parameter A and then click to select the number of Parameter A.
- **Offset:** Double click this cell to enter an offset value.
- **Operator:** Double click this cell to view a list of logical operators and then click to select one.
- **Parameter B:** Double click this cell to view a list of Parameters and then click to select one as Parameter B.
- **Param. B No:** Double click this cell to view a numbers list for Parameter B and then click to select the number of Parameter B.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Counter Comparator.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Counter Comparator Parameters

Counter Comparator Parameters

Comparator Table | Comparator Presets

No	Parameter A	Param.A No	Offset	Operator	Parameter B	Param.B No	Ladder Comment (LC)	LC	Comment
CntCmp1	Cnt	1	0	>	Cnt	1		No	
CntCmp2	Cnt	1	0	>	Cnt	1		No	
CntCmp3	CntPrst	20	-5670	>=	Cnt	24	Motor Break	Yes	Offset will be changed
CntCmp4	CntCmpPrst	24	670	<>, !=	CntPrst	2		No	
CntCmp5	Cnt	1	0	>	Cnt	1		No	
CntCmp6	Cnt	1	0	>	Cnt	1		No	
CntCmp7	Cnt	1	0	>	Cnt	1		No	
CntCmp8	Cnt	1	0	>	Cnt	1		No	
CntCmp9	Cnt	1	0	>	Cnt	1		No	
CntCmp10	Cnt	1	0	>	Cnt	1		No	
CntCmp11	Cnt	1	0	>	Cnt	1		No	
CntCmp12	Cnt	1	0	>	Cnt	1		No	
CntCmp13	Cnt	1	0	>	Cnt	1		No	
CntCmp14	Cnt	1	0	>	Cnt	1		No	
CntCmp15	Cnt	1	0	>	Cnt	1		No	
CntCmp16	Cnt	1	0	>	Cnt	1		No	
CntCmp17	Cnt	1	0	>	Cnt	1		No	

Format: (Parameter A + Offset) [<, <=, =, !=, >, >=] (Parameter B)

CntCmp4 = ON, if; (CntCmpPrst24 + 670) != (CntPrst2)

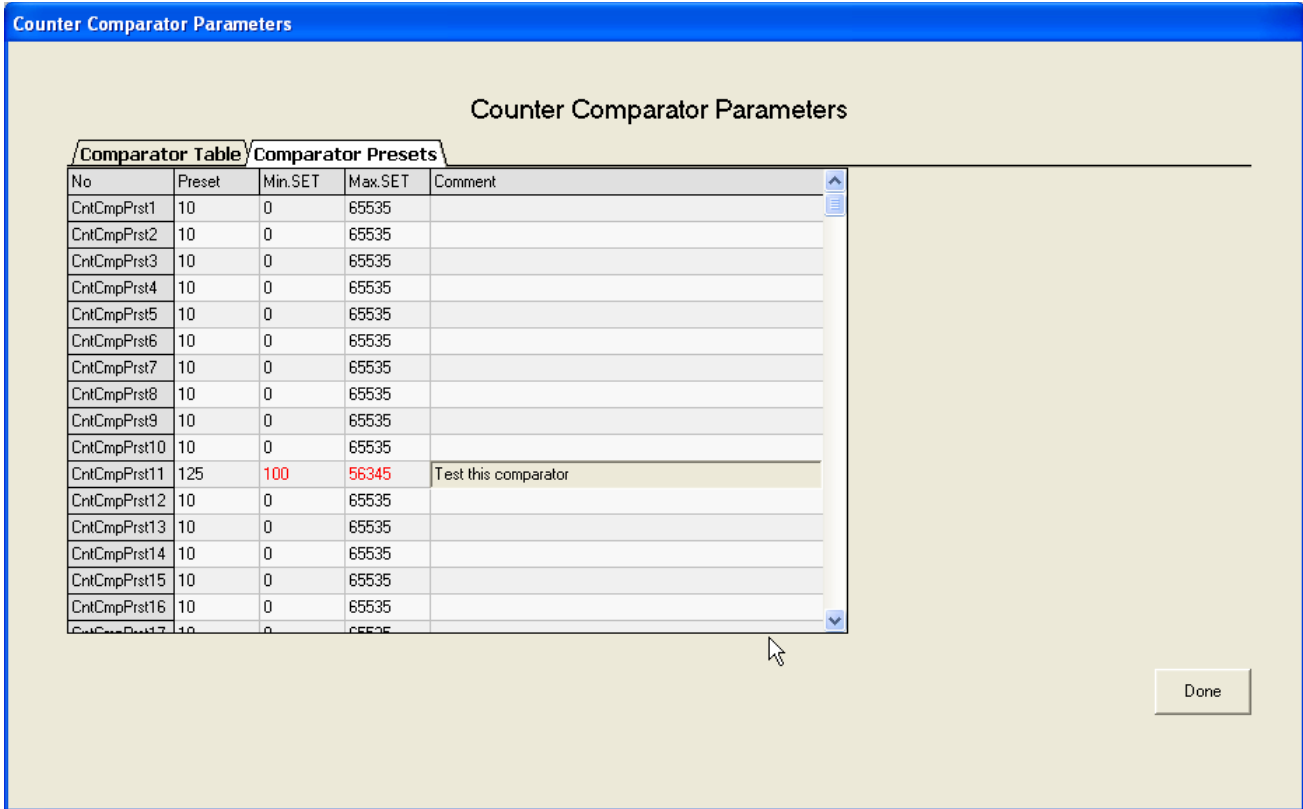
Offset : -9999 ... 9999

Done

5.9.2 Counter Comparator Presets Table

Press Comparator Presets tab in the Counter Comparator Parameters Screen to access Counter Comparator Presets Table. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Preset:** Enter default Preset value for each Counter Comparator Preset.
- **Min. SET:** Enter minimum value for Preset that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **Max. SET:** Enter maximum value for Preset that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **Comment:** .Place a comment for documentation purposes.



5.10 Fast Input Counter Parameters Screen

Press Settings-> Fast Input Counters to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Preset:** Enter default Preset value for each Fast Input Counter Preset.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Fast Input Counter.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

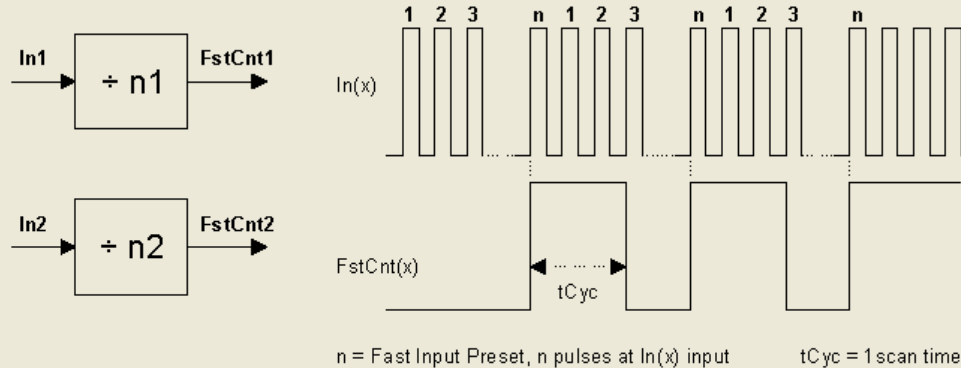
Fast Input Counter Parameters

Fast Input Counter Parameters



No	Preset	Ladder Comment (LC)	LC	Comment
FstCnt1	12	Encoder input	Yes	Use 100 pulse encoder
FstCnt2	15		No	

- In1 input is the input of 1.Fast Input Counter (FstCnt1) and In2 input is the input of 2.Fast Input Counter (FstCnt2).
- Fast Counter periodically counts 'Preset' number of Rising edges of In(x) and FstCnt(x) becomes ON for 1 Scan Time.
- Duration of 'Preset' number of Rising edges of In(x) should be greater than 2xScan time so that FstCnt(x) shall be ON and OFF periodically.
- Please refer to Technical Specification and User's Manual for correct use and timing information.



Done

5.11 State Machine Designer Screen

Press Settings-> State Machines A/B to access this sub screen.

This screen is composed of 6 tabs. Press the relevant tab to access the State Machine A Table, State Machine A Inputs Table, State Machine A Outputs Table, State Machine B Table, State Machine B Inputs Table or State Machine B Outputs Table.

5.11.1 State Machine A Table

Press Sm_A Table tab in the State Machine Designer Screen to access State Machine A Table. Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are colored to maintain table more readable when cell value is other than the default value.

To insert or delete a line in the State Machine Table, double click State No cell of the relevant row. A comment list appears. Choose the appropriate comment. If a new line is inserted or a line is deleted then the following rows will be shifted up/down and the indexes of Next States will be updated accordingly. Also, State Machine A's parameters is already used in Menu Designer Table, its index will also be updated accordingly.

Retention selection of State Machine A is done via the radio button group below the table.

- **C1:** Condition 1. Double click to view condition list and click to choose one.
- **C1 Status:** Status or type of Condition 1. Double click to view condition status list and click to choose one.
- **C1 Next:** Next State's number to jump in case Condition 1 happens. Double click to view State Number list and click to choose one.
- **C2:** Condition 2. Double click to view condition list and click to choose one.
- **C2 Status:** Status or type of Condition 2. Double click to view condition status list and click to choose one.
- **C2 Next:** Next State's number to jump in case Condition 2 happens. Double click to view State Number list and click to choose one.
- **Q1...Q16:** ON/OFF value of each State Machine A output for each state separately. Double click to toggle ON/OFF.
- **t.SET:** Double click to enter default preset value of internal timer of State Machine A (a separate value for each state).
- **Unit:** Double click to view time base list (and click to choose one) of internal timer of State Machine A (a separate time base for each state).
- **t.Min:** Enter minimum value for t.SET that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **t.Max:** Enter maximum value for t.SET that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **Comment:** .Place a comment for documentation purposes.

State Machine Designer


A: State Machine Designer

State No	C1	C1 Status	C1 Next	C2	C2 Status	C2 Next	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	t.SET	Unit	t.Min.	t.Max.	Comment	
1 (Rst)	Tmr	...	2. State	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
2 (Jmp)	In1	DN	3. State	Tmr	...	3. State	OFF	ON	OFF	ON	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	ON	01:33	Min:Sec	00:00	99:59	
3	In12	DN	4. State	Tmr	...	4. State	OFF	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	10:00	Min:Sec	01:00	20:59	Change time later
4	In3	DN	5. State	...	...	...	ON	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	00:00	1/100 sec.	00:00	99:99	
5	In5	DN	6. State	...	...	...	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	00:00	Min:Sec	00:00	99:59	
6	In1	DN	2. State	In2	ON	10. State	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	00:00	1/100 sec.	00:00	99:99	
7	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
8	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
9	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
10	Tmr	...	11. State	...	...	...	ON	ON	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	00100	TmrTick1	00100	00150	Set tick 1
11	Tmr	...	12. State	...	...	...	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	ON	00200	TmrTick1	00050	00250	
12	Tmr	...	6. State	...	...	...	ON	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	ON	OFF	ON	OFF	ON	OFF	ON	001.0	1/10 sec.	000.0	999.9	
13	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
14	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
15	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
16	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	
17	...	...	...	...	...	...	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	001.0	1/10 sec.	000.0	999.9	

State Machine A: Retentive:

No

Yes

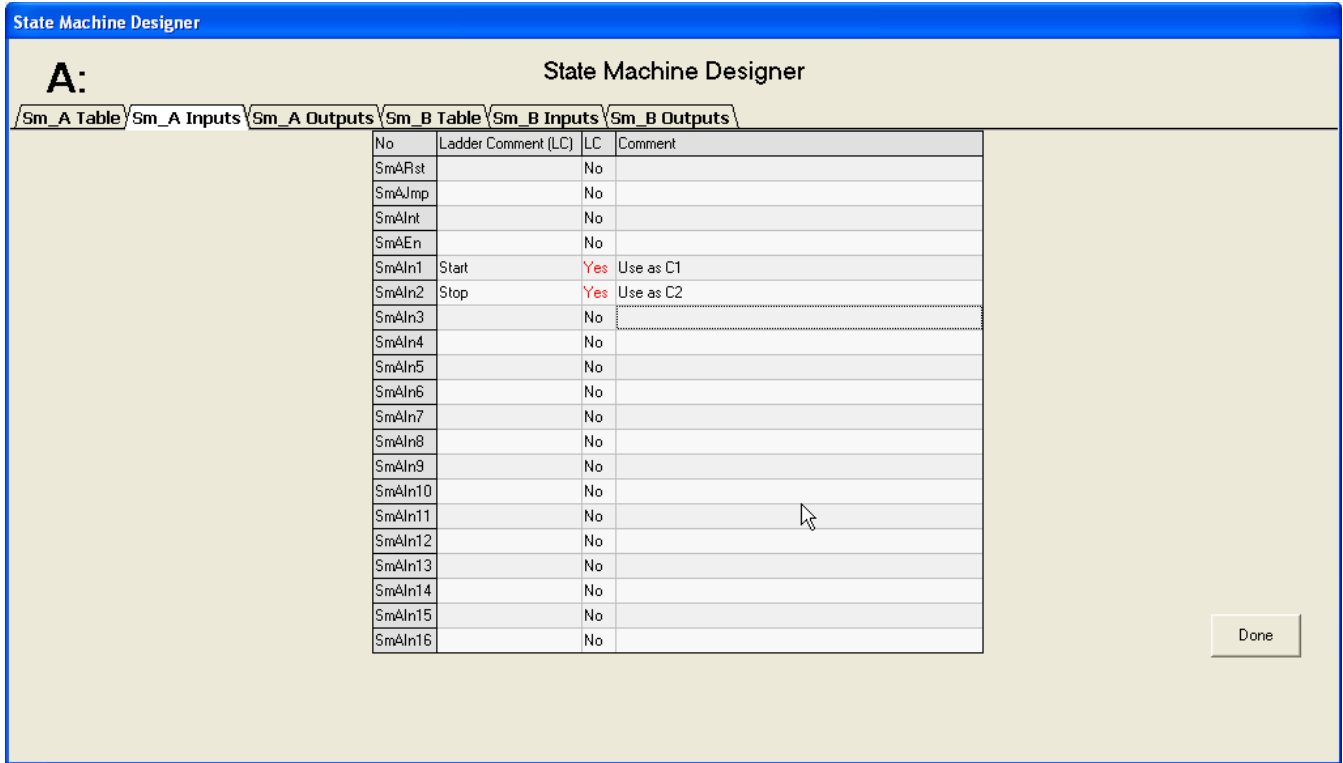
 When SmARst is ON; execution jumps to the State at Line 1 (from any State).
 When SmAJmp is ON; execution jumps to the State at Line 2 (from any State).
 SmARst input is more prior than SmAJmp input.
 Condition 1 (C1) is more prior than Condition 2 (C2).
 Tmr in column C1 and C2 represents internal timer of State Machine A.
 In1 ... In16 in column C1 and C2 represent SmAIn1 ... SmAIn16 inputs of State Machine A.

Done

5.11.2 State Machine A Inputs Table

Press Sm_A Inputs tab in the State Machine Designer Screen to access State Machine A Inputs Table. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

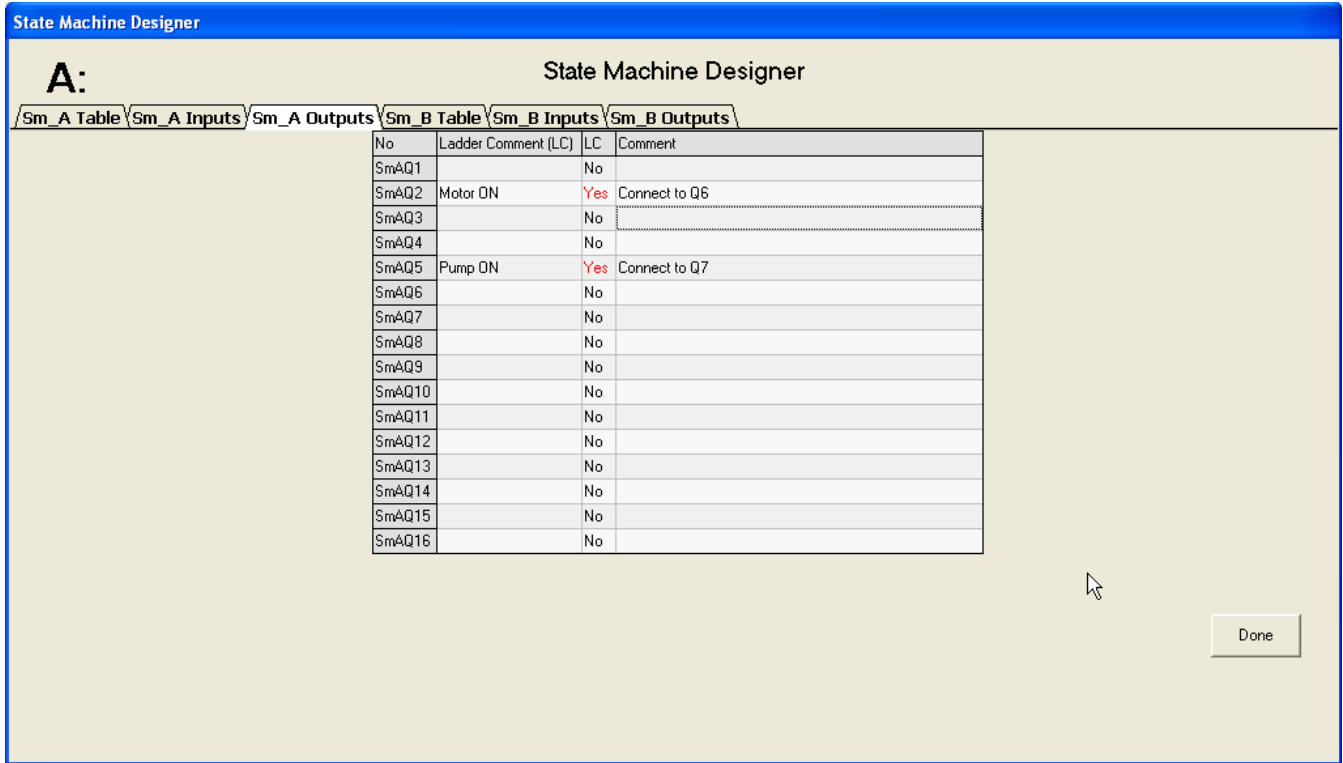
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected input of State Machine A.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.



5.11.3 State Machine A Outputs Table

Press Sm_A Outputs tab in the State Machine Designer Screen to access State Machine A Outputs Table. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected output of State Machine A.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.



5.11.4 State Machine B Table

Press Sm_B Table tab in the State Machine Designer Screen to access State Machine B Table.

State Machine B Table contains same information as in State Machine A Table. Please refer to State Machine A Table section for details.

5.11.5 State Machine B Inputs Table

Press Sm_B Inputs tab in the State Machine Designer Screen to access State Machine B Inputs Table.

State Machine B Inputs Table contains same information as in State Machine A Inputs Table. Please refer to State Machine A Inputs Table section for details.

5.11.6 State Machine B Outputs Table

Press Sm_B Outputs tab in the State Machine Designer Screen to access State Machine B Outputs Table.

State Machine B Outputs Table contains same information as in State Machine A Outputs Table. Please refer to State Machine A Outputs Table section for details.

5.12 Front Panel F Keys Screen

Press Settings-> Front Panel F Keys to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **FtON:** Filter ON time in seconds with a resolution of 1/100 second. Minimum filter time is 0 and maximum filter time is 2.5 seconds. Refer to Ladder Elements section about filtered key inputs.
- **FtOFF:** Filter OFF time in seconds with a resolution of 1/100 second. Minimum filter time is 0 and maximum filter time is 2.5 seconds. Refer to Ladder Elements section about filtered key inputs.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Front Panel F Key.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Front Panel F Keys

Front Panel F Keys

No	FtON	FtOFF	Ladder Comment (LC)	LC	Comment
Key1	0.00	0.00		No	
Key2	1.00	2.50	Start Button	Yes	Review filter time
Key3	0.30	0.40		No	

FtON: OFF->ON filter time (0 - 2.50 seconds)

FtOFF: ON->OFF filter time (0 - 2.50 seconds)

Done

The diagram shows a square wave signal labeled 'Key'. Below it, a filtered signal labeled 'KeyFit' is shown. The rising edge of KeyFit is delayed from the rising edge of Key by a time interval labeled 'FtON'. The falling edge of KeyFit is delayed from the falling edge of Key by a time interval labeled 'FtOFF'. Dotted vertical lines indicate the original key transitions, and horizontal double-headed arrows indicate the filter delays.

5.13 0-10V Analog Input Parameters Screen

Press Settings-> 0-10V Analog Inputs to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **0V Reading Value:** Double click to enter the conversion result (value) when analog input is 0V. This value may be greater or less than 10V Reading value.
- **10V Reading Value:** Double click to enter the conversion result (value) when analog input is 10V. This value may be greater or less than 0V Reading value.

- **Samples:** Double click to view number of samples list and choose one. Analog input will be sampled entered times, arithmetic mean will be calculated and converted according to 0V/10V Reading Values.
- **LCD Format:** Double click to view LCD Format list and choose one. This format determines how selected analog input value will be displayed on LCD module (decimal point position).
- **Comment:** .Place a comment for documentation purposes.

0 - 10V Analog Input Parameters

0 - 10V Analog Input Parameters

No	0V Reading Value	10V Reading Value	Samples	LCD Format	Comment
An10VIn1	0	500	2	#	
An10VIn2	-100	600	1	#.#	Increasing
An10VIn3	-50	150	8	#.##	
An10VIn4	250	-250	16	#.#	Decreasing

0V Reading Value, 10V Reading Value; Valid range: -999 ... +1000

Increasing

10V Reading Value > 0V Reading Value

Decreasing

0V Reading Value > 10V Reading Value

Done

5.14 Analog Comparator Parameters Screen

Press Settings-> Analog Comparators to access this sub screen.

This screen is composed of 3 tabs. Press the relevant tab to access Analog Comparator Table, Analog Comparator Preset Table or Analog Comparator Hysteresis Table.

5.14.1 Analog Comparator Table Screen

Press Comparator Table tab in the Analog Comparator Parameters Screen to access Analog Comparator Table. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more

readable when cell value is other than the default value. Select one of the rows and read the exact form of comparison expression of the selected Analog Comparator below table in blue color.

- **Parameter A:** Double click this cell to view a list of Parameters and then click to select one as Parameter A.
- **Param. A No:** Double click this cell to view a numbers list for Parameter A and then click to select the number of Parameter A.
- **Operator:** Double click this cell to view a list of logical operators and then click to select one.
- **Parameter B:** Double click this cell to view a list of Parameters and then click to select one as Parameter B.
- **Param. B No:** Double click this cell to view a numbers list for Parameter B and then click to select the number of Parameter B.
- **AnHysCmp No:** Double click this cell to view a numbers list for Hysteresis and then click to select. Hysteresis selection is possible and valid only when operator is selected as (+Hys) or (-Hys).
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Analog Comparator.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Analog Comparator Parameters

Analog Comparator Parameters

Comparator Table | Comparator Presets | Comparator Hysteresis Values

No	Parameter A	Param.A No	Operator	Parameter B	Param.B No	AnCmpHys No	FION(sec)	FIOFF(sec)	Ladder Comment (LC)	LC	Comment
AnCmp1	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp2	AnIn	2	>=	AnCmpPrst	1	---	00.0	00.0	Pressure input	Yes	Correct LCD Format
AnCmp3	AnCmpPrst	3	(+) Hys	PTC	1	AnCmpHys1	05.0	02.3	Temperature input	Yes	
AnCmp4	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp5	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp6	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp7	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp8	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp9	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp10	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp11	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp12	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp13	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp14	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp15	PTC	1	>	PTC	1	---	00.0	00.0		No	
AnCmp16	PTC	1	>	PTC	1	---	00.0	00.0		No	

AnCmp3 = ON, if; (AnCmpPrst3) >= (PTC1 + AnCmpHys1)
 AnCmp3 = OFF, if; (AnCmpPrst3) <= (PTC1)

Done

5.14.2 Analog Comparator Presets Table

Press Comparator Presets tab in the Analog Comparator Parameters Screen to access Analog Comparator Presets Table. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Preset:** Enter default Preset value for each Analog Comparator Preset.
- **Min. SET:** Enter minimum value for Preset that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **Max. SET:** Enter maximum value for Preset that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **LCD Format:** Double click to view LCD Format list and choose one. This format determines how selected analog comparator Preset value will be displayed on LCD module (decimal point position).
- **Comment:** .Place a comment for documentation purposes.

Analog Comparator Parameters

Analog Comparator Parameters

Comparator Table | Comparator Presets | **Comparator Hysteresis Values**

No	Preset	Min.SET	Max.SET	LCD Format	Comment
AnCmpPrst1	100	0	1000	#	
AnCmpPrst2	200	-150	350	#.#	Pressure threshold value
AnCmpPrst3	240	0	500	#.##	
AnCmpPrst4	100	0	1000	#	
AnCmpPrst5	100	0	1000	#	
AnCmpPrst6	100	0	1000	#	
AnCmpPrst7	100	0	1000	#	
AnCmpPrst8	100	0	1000	#	
AnCmpPrst9	100	0	1000	#	
AnCmpPrst10	100	0	1000	#	
AnCmpPrst11	100	0	1000	#	
AnCmpPrst12	100	0	1000	#	
AnCmpPrst13	100	0	1000	#	
AnCmpPrst14	100	0	1000	#	
AnCmpPrst15	100	0	1000	#	
AnCmpPrst16	100	0	1000	#	

Valid range: Min.Set <= Preset <= Max.Set, -999 <= Min.Set <= Max.Set, Min.Set <= Max.Set <= 1000

Done

5.14.3 Analog Comparator Hysteresis Table

Press Comparator Hysteresis Values tab in the Analog Comparator Parameters Screen to access Analog Comparator Hysteresis Table. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Hysteresis:** Enter default value for each Analog Comparator Hysteresis.
- **Min. SET:** Enter minimum value for Hysteresis that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **Max. SET:** Enter maximum value for Hysteresis that user is allowed to enter during parameter entry via device front panel. This parameter is used by device firmware to limit user entry.
- **LCD Format:** Double click to view LCD Format list and choose one. This format determines how selected analog comparator Hysteresis value will be displayed on LCD module (decimal point position).
- **Comment:** .Place a comment for documentation purposes.

Analog Comparator Parameters

Analog Comparator Parameters

Comparator Table		Comparator Presets		Comparator Hysteresis Values	
No	Hysteresis	Min.SET	Max.SET	LCD Format	Comment
AnCmpHys1	10	1	250	#	
AnCmpHys2	10	1	250	#	
AnCmpHys3	15	3	30	#.##	Pressure input hys.
AnCmpHys4	22	5	50	#.#	
AnCmpHys5	10	1	250	#	
AnCmpHys6	10	1	250	#	
AnCmpHys7	10	1	250	#	
AnCmpHys8	10	1	250	#	
AnCmpHys9	10	1	250	#	
AnCmpHys10	10	1	250	#	
AnCmpHys11	10	1	250	#	
AnCmpHys12	10	1	250	#	
AnCmpHys13	10	1	250	#	
AnCmpHys14	10	1	250	#	
AnCmpHys15	10	1	250	#	
AnCmpHys16	10	1	250	#	

Valid range: Min.Set <= Hysteresis <= Max.Set, 1 <= Min.Set <= Max.Set, Min.Set <= Max.Set <= 250

Done

5.15 Settings for Special Password Flags Screen

Press Settings-> Special Password Flags to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Password:** Enter a 4 character password value for each Flag. 0..9,A,B,C,D,E,F characters shall be used. When user enters a correct password via from panel of a device, relevant Special Password Flag (Contact) will be ON and then OFF for a single cycle.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Special Password Flag.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Settings for Special Password Flags

Settings for Special Password Flags

No	Password	Ladder Comment (LC)	LC	Comment
Pswd1	000F		No	
Pswd2	00F0		No	
Pswd3	0F00		No	
Pswd4	F000		No	

Note: You can use 0...9,A,B,C,D,E,F characters in password.

Done

5.16 Yearly Alarms Screen

Press Settings-> Yearly Alarms to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Channel No:** Displays channel no.
- **LCD Prog.:** Select “Yes” to enable programming of selected yearly alarm from the front panel of a device (SET3; password=FFF9).
- **ON Day:** Select ON day. Select “---” to disable this parameter.
- **ON Month:** Select ON month. Select “---” to disable this parameter.
- **ON Year:** Select ON year. Select “---” to disable this parameter.
- **OFF Day:** Select OFF day. Select “---” to disable this parameter.
- **OFF Month:** Select OFF month. Select “---” to disable this parameter.
- **OFF Year:** Select OFF year. Select “---” to disable this parameter.
- **Comment:** .Place a comment for documentation purposes.
- **Ladder Comment :** Any comment placed here is seen on ladder diagram for the selected yearly alarm. Select “Yes” to display ladder comment.

Yearly Alarms

Yearly Alarms

RTCYA1	RTCYA2	RTCYA3	RTCYA4	RTCYA5	RTCYA6	RTCYA7	RTCYA8	
Channel No	LCD Prog.	ON Day	ON Month	ON Year	OFF Day	OFF Month	OFF Year	Comment
1	Yes	6	June	2015	6	July	2018	

RTCYA1 Ladder Comment
 No
 Yes

January February March April May June July August September October November December

2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019

RTCYA parameters shall be updated via AR2 front panel with (SET3->Password=FFF9) if "LCD Prog." is "Yes".

Done

5.17 Weekly Alarms Screen

Press Settings-> Weekly Alarms to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Channel No:** Displays channel no.
- **LCD Prog.:** Select "Yes" to enable programming of selected weekly alarm from the front panel of a device (SET3; password=FFF8).
- **ON:** Select "Yes" to enable ON state of selected channel. If selected as "NO", selected channel's ON comparison is disabled.
- **ON Time:** Enter time when channel state becomes ON.
- **OFF:** Select "Yes" to enable OFF state of selected channel. If selected as "NO", selected channel's OFF comparison is disabled.
- **OFF Time:** Enter time when channel state becomes OFF.
- **Mon:** Select "Yes" to enable channel on Mondays.
- **Tue:** Select "Yes" to enable channel on Tuesdays.
- **Thr:** Select "Yes" to enable channel on Thursdays.
- **Wed:** Select "Yes" to enable channel on Wednesdays.
- **Fri:** Select "Yes" to enable channel on Fridays.
- **Sat:** Select "Yes" to enable channel on Saturdays.
- **Sun:** Select "Yes" to enable channel on Sundays.

- **Comment:** .Place a comment for documentation purposes.
- **Ladder Comment :** Any comment placed here is seen on ladder diagram for the selected weekly alarm. Select “Yes” to display ladder comment.

Weekly Alarms

Weekly Alarms

Channel No	LCD Prog.	ON	ON Time	OFF	OFF Time	Mon	Tue	Thr	Wed	Fri	Sat	Sun	Comment
1	Yes	Yes	03:25	Yes	12:55	No	Yes	No	Yes	No	No	Yes	
2	Yes	Yes	18:35	Yes	22:50	Yes	Yes	Yes	No	No	Yes	No	
3	Yes	Yes	05:35	No	15:40	No	No	No	No	Yes	No	No	
4	Yes	No	00:00	Yes	15:40	No	No	No	No	No	Yes	No	

RTCWA1 Ladder Comment

No

Yes

Monday 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

RTCWA parameters shall be updated via AR2 front panel with (SET3->Password=FFF8) if "LCD Prog." is "Yes".

Done

5.18 Configuration Flags Screen

Press Settings-> Configuration Flags to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Value:** Enter ON or OFF for each Configuration Flag. This value shall be altered during run-time is defined in menu designer. This value is stored in non-volatile memory and remains ON or OFF during power on and after until altered via front panel.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Configuration Flag.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.

Configuration Flags Power On Values

Configuration Flags Power On Values

No	Value	Ladder Comment (LC)	LC	Comment
CfgFlg1	ON	Motor	Yes	Motor ON
CfgFlg2	OFF		No	
CfgFlg3	ON		No	
CfgFlg4	OFF		No	

Done

5.19 System Settings Screen

Press Settings->System Settings to access this sub screen. Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected System contact.
- **LC:** Alter LC by double clicking; yes, no. If “yes”, ladder comment is seen on ladder diagram, if “no”, ladder comment is not placed on diagram.
- **Comment:** .Place a comment for documentation purposes.
- **RTC Day Light Saving:** Select day light saving mode of operation.
- **RTC Time Zone:** Select the time zone for the device location. Automatic day light saving is done according to the select time zone.

System Settings

System Settings

No	Ladder Comment (LC)	LC	Comment
PowerONRst		No	
ErrRetention		No	
ErrPTC1		No	
ErrPTC2		No	
ErrCommAny		No	
ErrCommG1		No	
ErrRTC		No	

RTC-Day Light Saving

Manual

Automatic (European)

RTC-Time Zone

GMT +0; London

GMT +1; Paris

GMT +2; Istanbul

5.20 MODBUS Settings Screen

Press Settings->MODBUS Settings to access this sub screen.

Only MODBUS RTU mod is supported.

AR2 is connected to an RS485 MODBUS RTU network as a “slave” via AR2-S-24VDC-MB1; AR2 MODBUS gateway. AR2-S-24VDC-MB1 has 2 RS485 port; first one is used to connect to an AR2 and the other is used to connect to a MOSBUS RTU Master.

The communication parameters of AR2-S-24VDC-MB1 and MOSBUS RTU Master should be the same. The adjustment should be done by the user via MODBUS Settings Screen for AR2 side.

Press Settings->MODBUS Settings to access to MODBUS Settings Screen (requires version 2.4 or later). The attributes located at this screen are listed below. The attributes adjusted by the used are saved at the non-volatile memory of AR2 and automatically transferred to AR2-S-24VDC-MB1 and activated after a successful communication between AR2 and AR2-S-24VDC-MB1.

After power on, if AR2-S-24VDC-MB1 can not communicate successfully with AR2, it uses following communication settings; 9600 baud, even parity, 1 stop bit, slave address = 10.

2 LEDs blink when a communication is successful between AR2-S-24VDC-MB1 and AR2, and between AR2-S-24VDC-MB1 and MODBUS master.

5.20.1 Baud Rate

This is the communication speed between AR2-S-24VDC-MB1 and MODBUS master. User may select; 9600, 19200 or 38400 baud.

5.20.2 “Parity / Stop Bit”

This is the communication Parity/Stop Bit between AR2-S-24VDC-MB1 and MODBUS master. User may select; “1 Stop Bit, Even Parity”, “1 Stop Bit, Odd Parity”, “1 Stop Bit, No Parity”, “2 Stop Bits, No Parity”

MODBUS specification does not define “1 Stop Bit, No Parity”. At this option, a transmitted or received character is composed of 10 bits. In MODBUS specification, a character is composed of 11 bits. AR2-S-24VDC-MB1 supports both 10 bits and 11 bits reception and transmission.

But suggested option is either “1 Stop Bit, Even Parity” or “1 Stop Bit, Odd Parity”. Because error detection at these options are more powerful.

5.20.3 Slave Address

This is the slave address of AR2-S-24VDC-MB1 (hence AR2) at the MODBUS RTU network.

“0” (or broadcast messages) address is not supported.

5.20.4 Allow Master to Write into; Check Box

This is the authentication of the Master to write any data into any register/coil of AR2. User should select the check box to give permission to MODBUS master to write. A single permission covers all coils and registers in AR2.

If the permission is not given (check box is not selected) AR2 returns “03-ILLEGAL DATA VALUE” exception message.

5.20.5 Allow Master to Read from; Check Box

This is the authentication of the Master to read any data from any register/coil of AR2. User should select the check box to give permission to MODBUS master to read. A single permission covers all coils and registers in AR2.

If the permission is not given (check box is not selected) AR2 returns “03-ILLEGAL DATA VALUE” exception message.

5.20.6 Minimum Delay before Response to Master

With this setting, user may delay a ready response of AR2-S-24VDC-MB1 to the MODBUS master. This delay is in milliseconds. For fastest response this setting should be “0”.

This feature may be helpful when connecting AR2-S-24VDC-MB1 to MODBUS masters running on non-real time computing environment (like a PC running Windows or Linux operation systems).

MODBUS specification defines a 3,5 character long minimum silence duration for any master/slave to start sending a new message or response to a received message. This duration may be very short for a slow or for a non-real time MODBUS Master. This delay setting instructs AR2-S-24VDC-MB1 to delay a response to the MODBUS Master (hence delay to occupy the RS485 half duplex line). Of course this delay will decrease the communication performance.

This delay is applied to all LC responses from AR2-S-24VDC-MB1 to MODBUS master, including the “Exception” messages.

MODBUS Settings

MODBUS Settings

No	Ladder Comment (LC)	LC	Comment
NetIn1		No	
NetIn2		No	
NetIn3		No	
NetIn4		No	
NetIn5		No	
NetIn6		No	
NetIn7		No	
NetIn8		No	
NetIn9		No	
NetIn10		No	
NetIn11		No	
NetIn12		No	
NetIn13		No	
NetIn14		No	
NetIn15		No	
NetIn16		No	
NetIn17		No	

Allow Master to write into
 Allow Master to read from
 Slave Address:

Baud Rate
 9600
 19200
 38400

Stop Bit / Parity
 1 Stop Bit, Even Parity
 1 Stop Bit, Odd Parity
 1 Stop Bit, No Parity
 2 Stop Bits, No Parity

Minimum delay before response to Master (milliseconds):
 Enter "0" for fastest response

5.21 Run Time Screens Screen

Press Settings->Run Time Screens to access this sub screen.

This screen contains Welcome Screen Table and Tables of 1...32.Screens. Press the relevant tab to access tables.

Double click a cell to enter a new value or alter previously entered value. Some cells are colored to maintain table more readable when cell value is other than the default value.

Below the Welcome Screen Table;

- **Flashing ON Time:** Backlight is ON for this duration and then OFF, if selected sub screen's backlight is selected as flashing.
- **Flashing OFF Time:** Backlight is OFF for this duration and then ON, if selected sub screen's backlight is selected as flashing.
- **I/O States Screen Backlight:** Select backlight status (type) when active screen is I/O States Screen.

Below tables of 1...32.Screens;

- **Number of Loops:** Timed screens loops entry times and then disappears. Time required to loop all is displayed below the entry.
- **Ladder Comment (LC):** Any comment placed here is seen on ladder diagram for the selected Screen. Click yes to activate comment.

Tables of 1...32.Screens;

- **Active:** Double click to toggle Yes/No. Only active sub screens are displayed on LCD.
- **Line 1:** Upper line (16 characters) of selected sub screen.
- **Line 2:** Lower line (16 characters) of selected sub screen.
- **Parameter:** Double click to view a list of parameters and select one to display its real time value, located in the selected sub screen. Not valid for Welcome Screen.
- **Parameter:** Double click to view a list of numbers and select one for the selected parameter to display its real time value, located in the selected sub screen. Not valid for Welcome Screen.
- **Row:** Double click to view a list of row numbers and select one for the selected parameter to locate in the selected sub screen. Not valid for Welcome Screen.
- **Col.:** Double click to view a list of column numbers and select one for the selected parameter to locate in the selected sub screen. Not valid for Welcome Screen.
- **Duration:** Double click to enter duration in seconds that the selected sub screen will appear on LCD before following sub screen.
- **B/Light:** Double click to view a list and select one for the status of backlight for the selected sub screen.

5.22 Menu Design Screen

Press Settings->Menu Designer to access this sub screen.

This screen contains Level 1, Level2 and Level 3 Menu Design tables. Click the relevant tab to access the desired table.

Double click a cell to enter a new value or alter previously entered value. Use the bar on the right side of the table to access/scroll the lines that can not be displayed on the screen. Some cells are colored to maintain table more readable when cell value is other than the default value.

Menu design has a 3 level structure. Each level is separate and independent from others. Each level is activated by SET1, SET2 and SET3 keys located on the front Panel of device.

For each level, separate password protection and parameter set can be designed via Menu Design Tables.

Password table;

- **Password Active:** Double click to toggle Yes/No. Selected level is password protected if set to Yes and a password entry screen is displayed before parameter entry screens.
- **Line 1:** Upper line (16 characters) of password entry screen for the selected level.
- **Line 2:** Lower line (16 characters) of password entry screen for the selected level.
- **Password:** Double click to enter the password for the selected level. 0...9, A,B,C,D,E,F are defined for password string. A password is always required for Level 3.
- **Row:** Double click to select the row to locate the password string on the LCD.
- **Col.:** Double click to select the column to locate the password string on the LCD.

Parameter table;

- **Line 1:** Upper line (16 characters) for the selected parameter entry screen at the selected level.
- **Line 2:** Lower line (16 characters) for the selected parameter entry screen at the selected level.
- **Parameter:** Double click to select a parameter type.
- **Param.No:** Double click to select a parameter number.
- **Row:** Double click to select the row to locate the parameter on the LCD.

- **Col.:** Double click to select the column to locate the parameter on the LCD.
- **Comment:** .Place a comment for documentation purposes.

It is possible to add/delete row(s) to/from Parameter Table. Double click Seq.No (sequence no) cell of relevant row and view the following command set and choose appropriate one;

- **Insert Line:** .Inserts a new row before the selected line. Following lines shifted one row down.
- **Delete Line:** .Deletes selected line. Following lines shifted one row up.
- **Move Line:** .Moves selected line to another line number. Other lines shifted one row up/down accordingly.
- **Mark as Last Line:** .Selected line becomes last line for the selected level. This line is not displayed and parameter entry ends when this line is reached.
- **Erase Last Line Mark:** .Last line mark of selected line is erased and selected line is included in the parameters list to be displayed before menu entry ends.

To view the exact image of password and parameter screens that will appear on LCD is simulated on the LCD image on upper right side of the screen. Click on a row and view its image on LCD.

Menu Design

Menu Design

Level 1

Level 1 Level 2 Level 3

Password Active	Line 1	Line 2	Password	Row	Col.
Yes	Şifre / Password	L1:	73AF	2	7

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1	Ş	i	f	r	e	/	P	a	s	s	w	o	r	d
2	L	1	:				#	#	#	#				

Seq.No	Line 1	Line 2	Parameter	Param.No	Row	Col.	Comment
1	Parameter 1	L1	Tmr; tA	1	1	6	
2	Parameter 2	L1	Cnt; Preset	1	2	3	
3	Parameter 3	L1	CntCmp; Preset	1	2	10	
4	Parameter 4	L1	SmB; t.Set	1	2	12	
5 - End	Parameter 5	L1	Tmr; tA	1	2	6	
6 - End	Parameter 6	L1	Tmr; tA	1	2	6	
7 - End	Parameter 7	L1	Tmr; tA	1	2	6	
8 - End	Parameter 8	L1	Tmr; tA	1	2	6	
9 - End	Parameter 9	L1	Tmr; tA	1	2	6	
10 - End	Parameter 10	L1	Tmr; tA	1	2	6	
11 - End	Parameter 11	L1	Tmr; tA	1	2	6	
12 - End	Parameter 12	L1	Tmr; tA	1	2	6	
13 - End	Parameter 13	L1	Tmr; tA	1	2	6	
14 - End	Parameter 14	L1	Tmr; tA	1	2	6	
15 - End	Parameter 15	L1	Tmr; tA	1	2	6	
16 - End	Parameter 16	L1	Tmr; tA	1	2	6	
17 - End	Parameter 17	L1	Tmr; tA	1	2	6	

Done

6 Contacts, Coils, Links

6.1 Contacts

GEMO Ladder Editor contains 5 contact columns. One can use any kind of contact of any ladder element as many times as required at any contact cell without any limitation. Contacts are connected in series and/or parallel towards coil column with any link connection, provided that all connections of any link should be connected to another contact or coil.

6.1.1 Normally Open



Normally open contact out of selected ladder element. Normally open contact is active (ON – conducting) when output of selected ladder element is ON

6.1.2 Normally Closed



Normally closed contact out of selected ladder element. Normally closed contact is active (ON – conducting) when output of selected ladder element is OFF

6.1.3 Rising Edge



Rising edge output of the selected ladder element. Rising edge contact is active (ON – conducting) only for 1 scan time (Pulse out) when normally open output of selected ladder element has a transition from OFF to ON.

6.1.4 Falling Edge



Falling edge output of the selected ladder element. Falling edge contact is active (ON – conducting) only for 1 scan time (Pulse out) when normally open output of selected ladder element has a transition from ON to OFF.

6.1.5 Link



Link contact conducts input to output as is.

6.1.6 Inverter



Inverter type contact conducts input to output as inverted. If input is ON, then output is OFF, and vice versa.

6.2 Coils

GEMO Ladder Editor contains 1 coil column. Coil is the destination of a connection. A coil is the input of a Ladder Element.

Coils have limitation in use. A specific coil can not be used more than one in a diagram. If it is used an error is generated by the editor. If multiple connections to a coil are required, these connections should be OR'ed at the input of that coil.

6.3 Links

GEMO Ladder Editor contains 5 link columns. Links connects contacts and coils. Contacts are connected in series and/or parallel towards coil column with any link connection, provided that all connections of any link should be connected to another contact or coil.

7 Ladder Components

7.1 Discrete Inputs

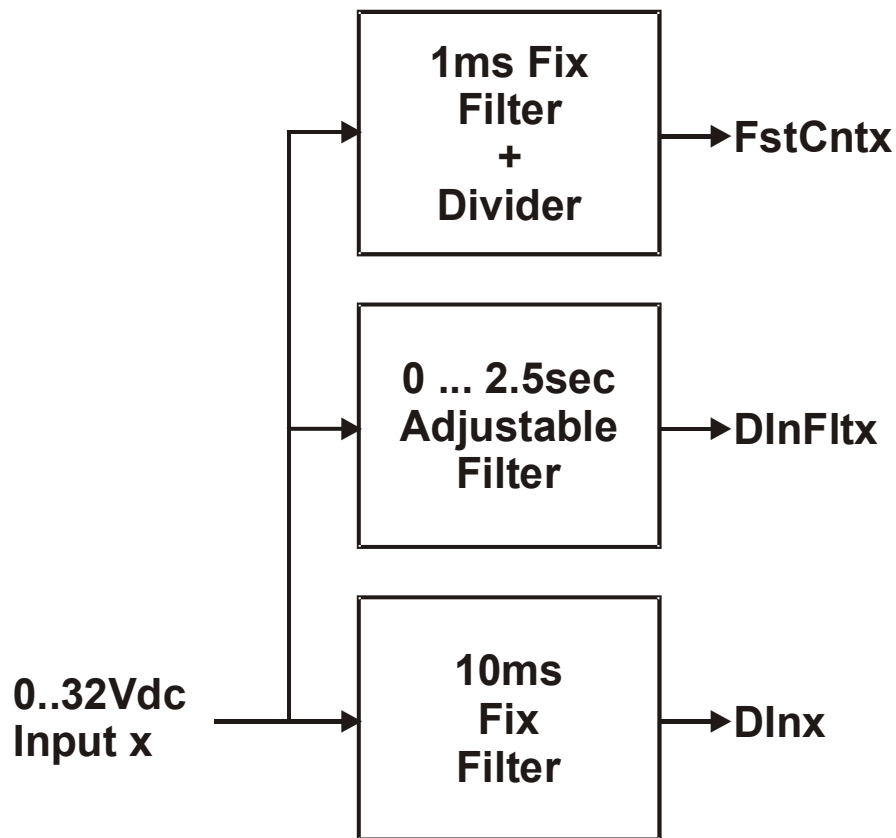
Block diagram of a physical digital input of device is shown below.

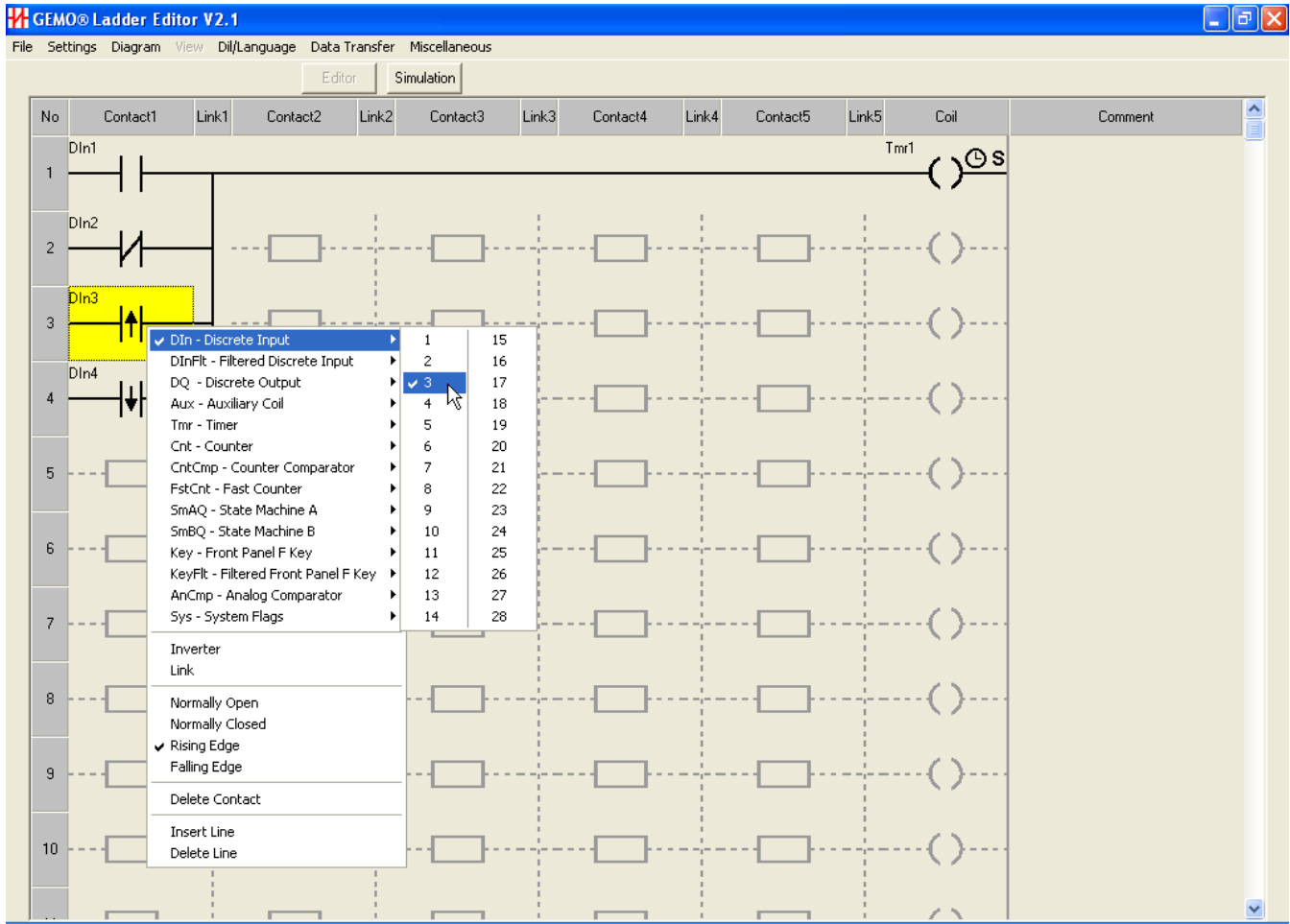
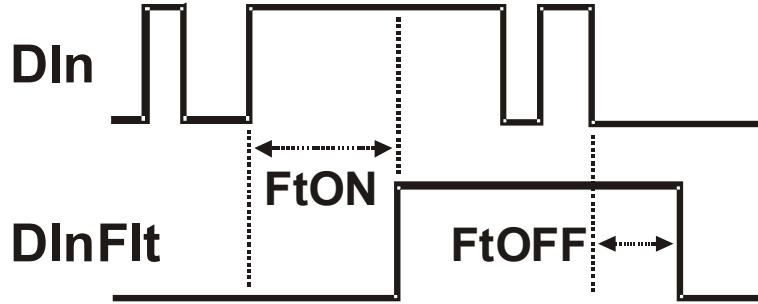
0...32Vdc digital signal input is filtered by a 10ms fixed filter and the filtered signal is used in ladder diagram as DIn (digital input) contact.

0...32Vdc digital signal input is filtered by an adjustable 0...2.5sec filter and the filtered signal is used in ladder diagram as DInFlt (filtered digital input) contact. ON and OFF filter time may be adjusted separately via Digital Input Settings Screen.

Filtered input waveform is shown below.

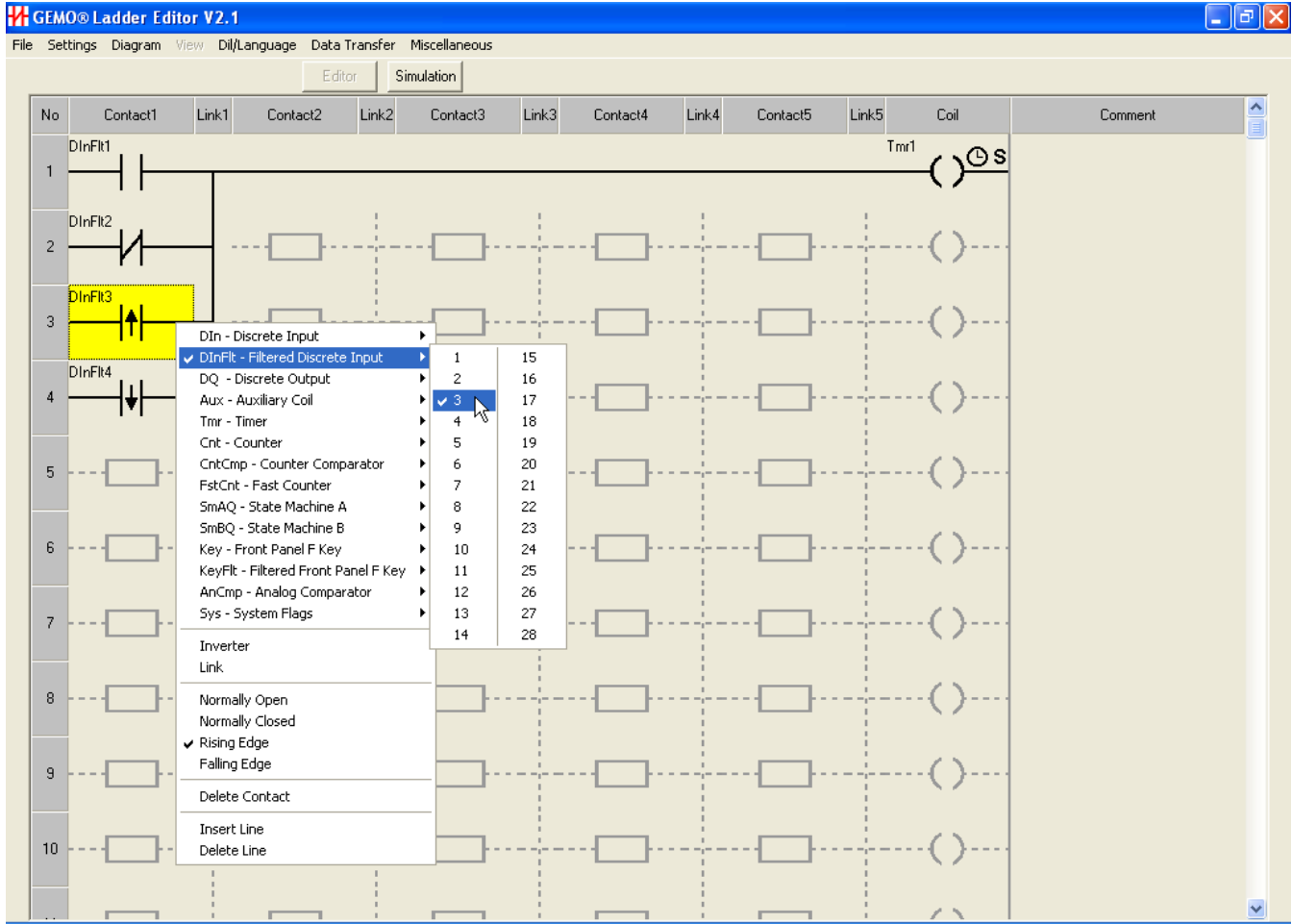
0...32Vdc digital signal input is filtered by a fixed 1ms filter and then applied to a divider. The divisor is the Preset value entered via Fast Input Counter Parameters Screen. The divided signal is used as FstCntx contact in ladder diagram. FstCntx is ON for only 1 scan time (a pulse).





7.2 Filtered Discrete Inputs

Refer to Discrete Inputs section for details.

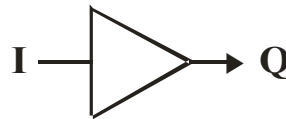


7.3 Discrete Outputs

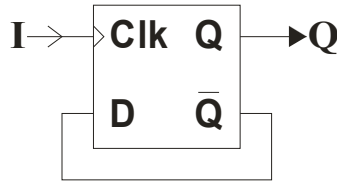
Discrete Outputs are physical outputs of a PLC.

Discrete outputs are both used in contact and coil columns. When used in contact columns, they represent ON/OFF/Rising Edge/Falling Edge state of a physical discrete output.

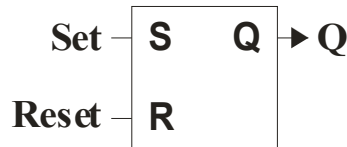
When used in coil column, a physical discrete output is addressed. A discrete output may be driven in 6 different ways as shown below.



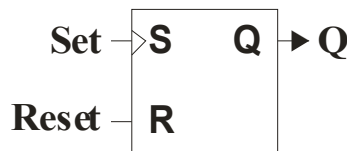
Digital Logic Representation of Coil Type



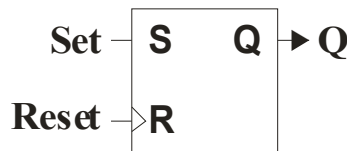
Digital Logic Representation of Toggle, Pulse



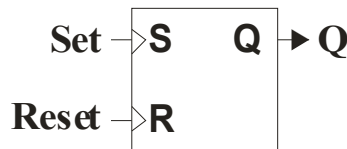
Digital Logic Representation of SET & RESET Level



Digital Logic Representation of SET Pulse & RESET Level



Digital Logic Representation of SET Level & RESET Pulse



Digital Logic Representation of SET & RESET Pulse

7.3.1 Coil Type

When used as a coil type, a discrete output state is the same (equal) of the state of the line it is connected to. If the line is ON, it is ON, if the line is OFF, it is OFF. A discrete output can exist only once as coil type in the whole diagram. Also, if a discrete output is used as a coil type once, it can not be used as “Toggle, Pulse”, “SET, Level”, “RESET, Level”, “SET, Pulse” or “RESET, Pulse”.

7.3.2 Toggle, Pulse

When used as toggle, pulse, a discrete output state is negated (reversed) when the state of the line it is connected to is pulsed as OFF -> ON. A discrete output can exist only once as toggle pulse in the whole diagram. Also, if a discrete output is used as toggle pulse once, it can not be used as “Coil Type”, “SET, Level”, “RESET, Level”, “SET, Pulse” or “RESET, Pulse”.

7.3.3 SET, Level

When used as SET, level, a discrete output state becomes ON when the state of the line it is connected to is ON and remains ON even if the state of the line becomes OFF. In order make the output OFF, a valid RESET signal should be applied to discrete output's RESET input. Therefore, if a discrete output has a SET level input, it should have a "RESET Level" or "RESET Pulse" type input.

A discrete output can exist only once as SET level in the whole diagram. Also, if a discrete output is used as SET Level once, it can not be used as "Coil Type", "Toggle, Pulse" or "SET, Pulse".

7.3.4 RESET, Level

When used as RESET, level, a discrete output state becomes OFF when the state of the line it is connected to is ON. In order make the output ON, a valid SET signal should be applied to discrete output's SET input. Therefore, if a discrete output has a RESET level input, it should have a "SET Level" or "SET Pulse" type input.

A discrete output can exist only once as RESET level in the whole diagram. Also, if a discrete output is used as RESET Level once, it can not be used as "Coil Type", "Toggle, Pulse" or "RESET, Pulse".

7.3.5 SET, Pulse

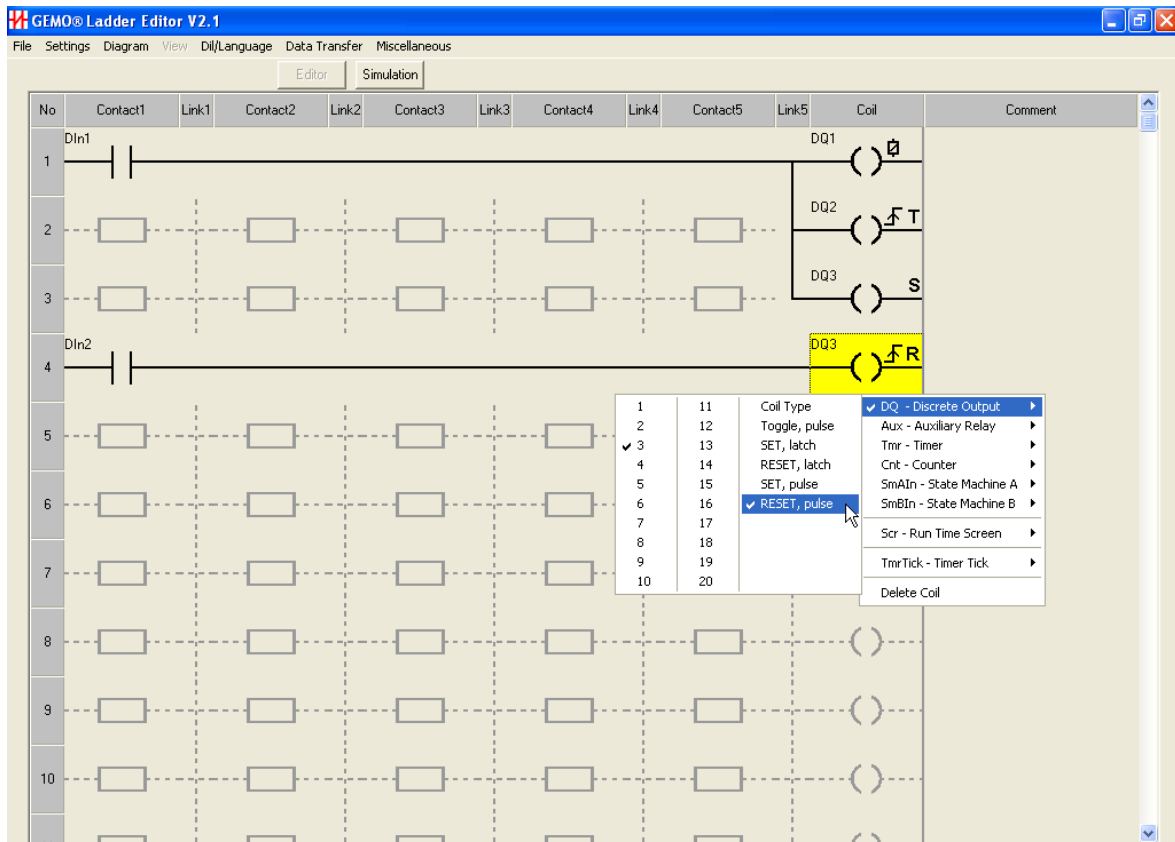
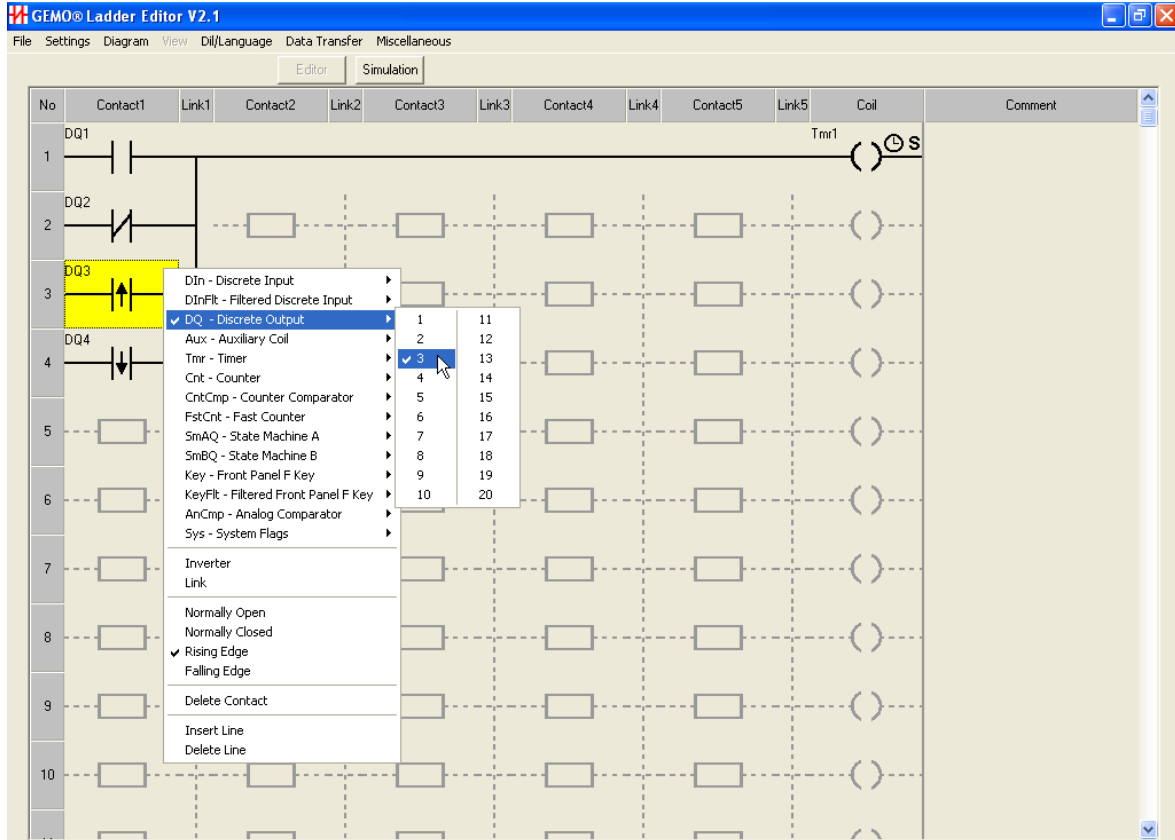
When used as SET, Pulse, a discrete output state becomes ON when the state of the line it is connected to is pulsed (OFF->ON) and remains ON even if the state of the line becomes OFF. In order make the output OFF, a valid RESET signal should be applied to discrete output's RESET input. Therefore, if a discrete output has a SET pulse input, it should have a "RESET Level" or "RESET Pulse" type input.

A discrete output can exist only once as SET pulse in the whole diagram. Also, if a discrete output is used as SET Pulse once, it can not be used as "Coil Type", "Toggle, Pulse" or "SET, Level".

7.3.6 RESET, Pulse

When used as RESET, Pulse, a discrete output state becomes OFF when the state of the line it is connected to is pulsed (OFF->ON). In order make the output ON, a valid SET signal should be applied to discrete output's SET input. Therefore, if a discrete output has a RESET pulse input, it should have a "SET Level" or "SET Pulse" type input.

A discrete output can exist only once as RESET Pulse in the whole diagram. Also, if a discrete output is used as RESET Pulse once, it can not be used as "Coil Type", "Toggle, Pulse" or "RESET, Level".



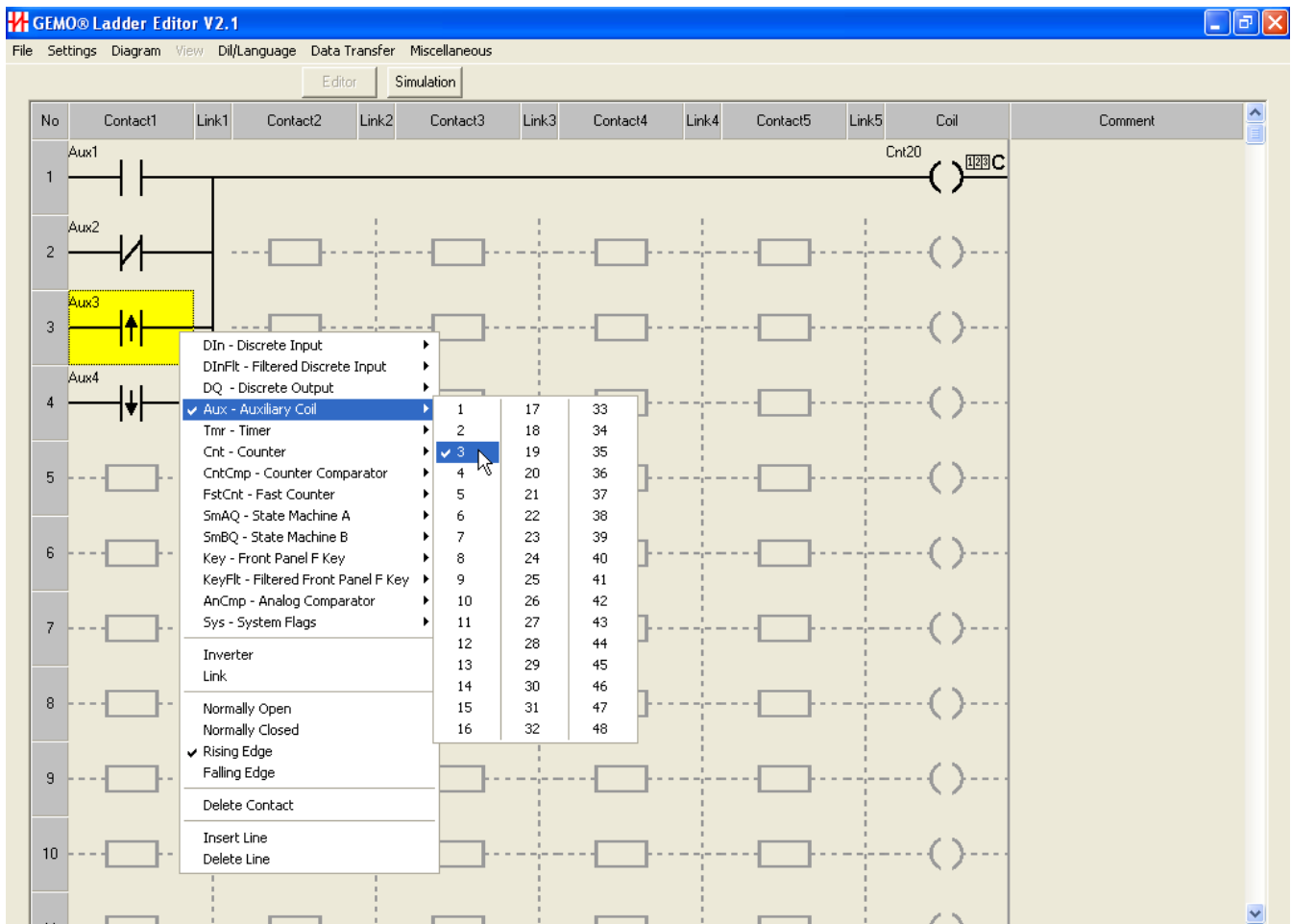
7.4 Auxiliary Relays

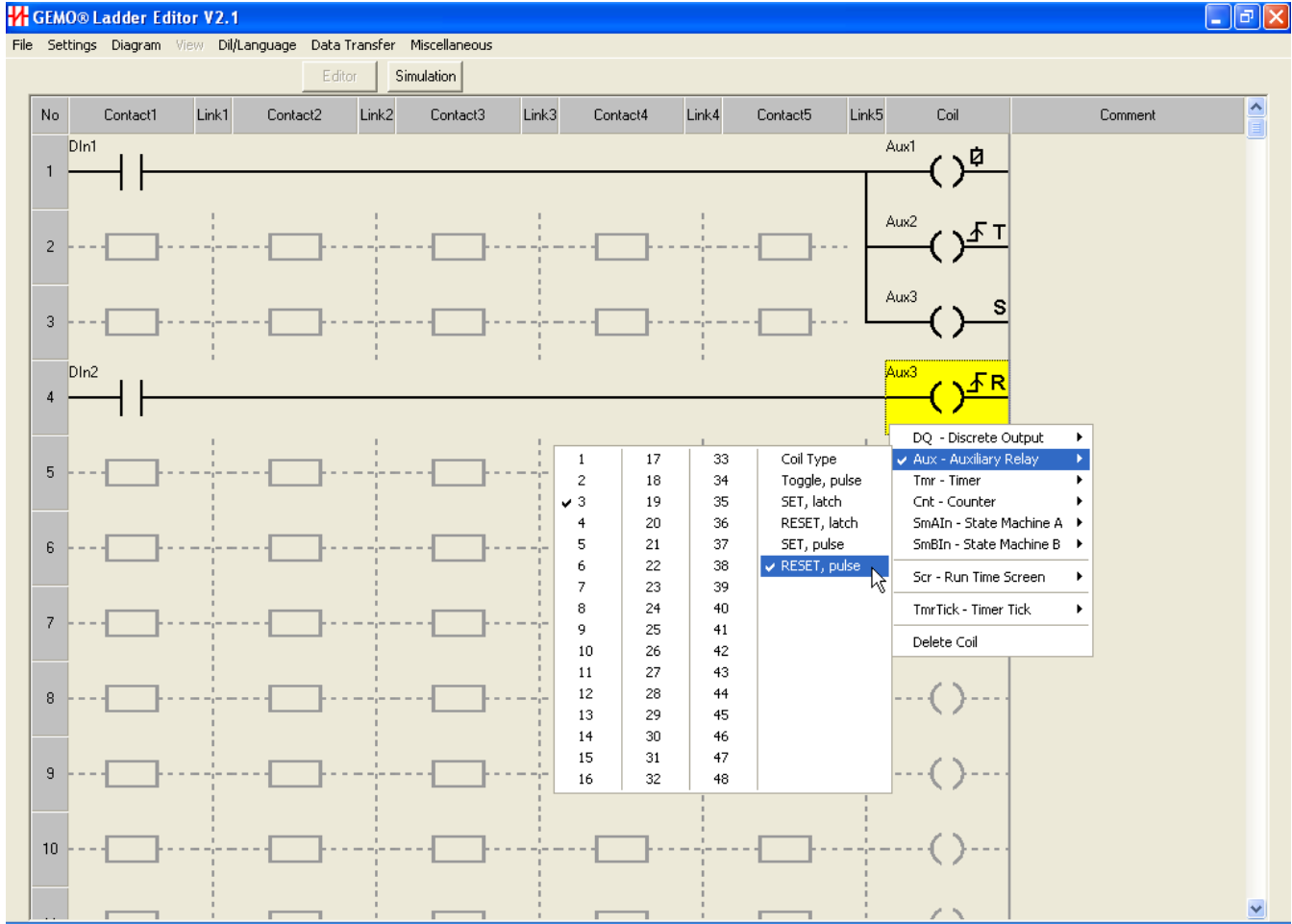
Auxiliary relays are imaginary outputs of a PLC. They are used to store a binary state or transfer one state a line to another line.

They have identical characteristics as discrete outputs. Refer to “Discrete Outputs” section for detailed behavior.

Aux48 has a special function. When used in Run Time Screen Tables, Aux48 holds the state of LCD backlight. If it is not used in Run Time Screen Tables, it can be used freely just like other Auxiliary Relays.

Auxiliary Relays may be **retentive** if set in the Auxiliary Relay Settings Screen. Refer to Retention section for more detail. Use retention carefully. Study all conditions that may happen during/after a power failure and/or during/after power is on and take precautions.

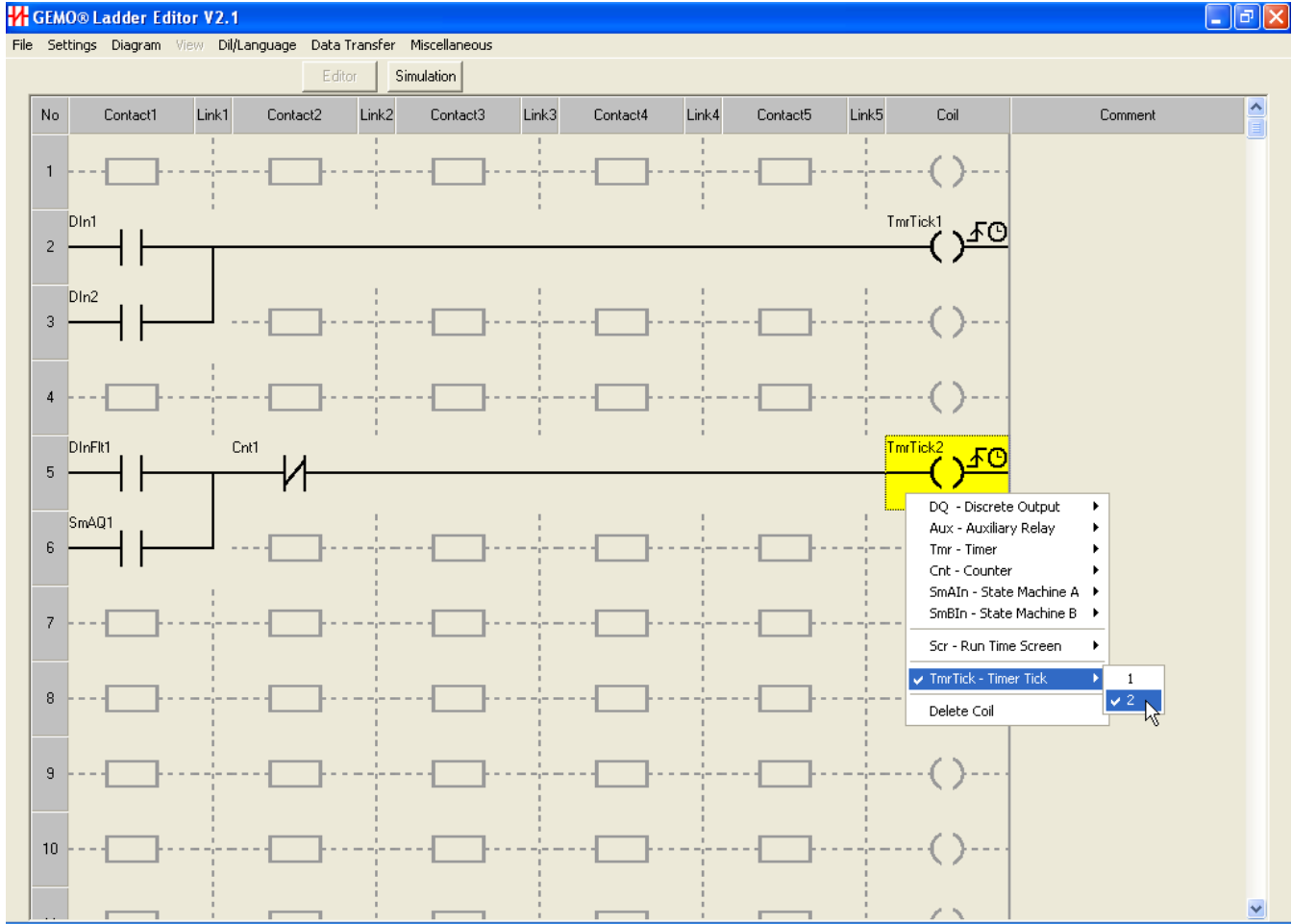




7.5 Timer Ticks

Click Settings -> Timer Ticks to access to Timer Tick Notes Screen.

Timer Ticks are time bases for Timers and internal timers of State Machines. There exist 2 timer ticks; TmrTick1 and TmrTick2. A timer tick is a coil in a diagram. When a timer tick signal has a transition from OFF->ON, the actual value of the timer, with time base selected as particular timer tick, decrements 1 count. So, a timer shall be used as a special event counter with plenty of built in output functions.



7.6 Timers

Click Settings -> Timers to access to Timer Parameters Screen. User can select function, time base and default Preset A and Preset B values of each timer in this screen.

Time base (resolution) of a timer shall be; 1/100 sec., 1/10 sec., 1 sec., 1 minute or 1 hour. Each timer can be used as a special event counter. In this case, time base should be selected as FstCnt1, FstCnt2 (Fast Input Counter inputs), TmrTick1 or TmrTick2 (Timer Ticks).

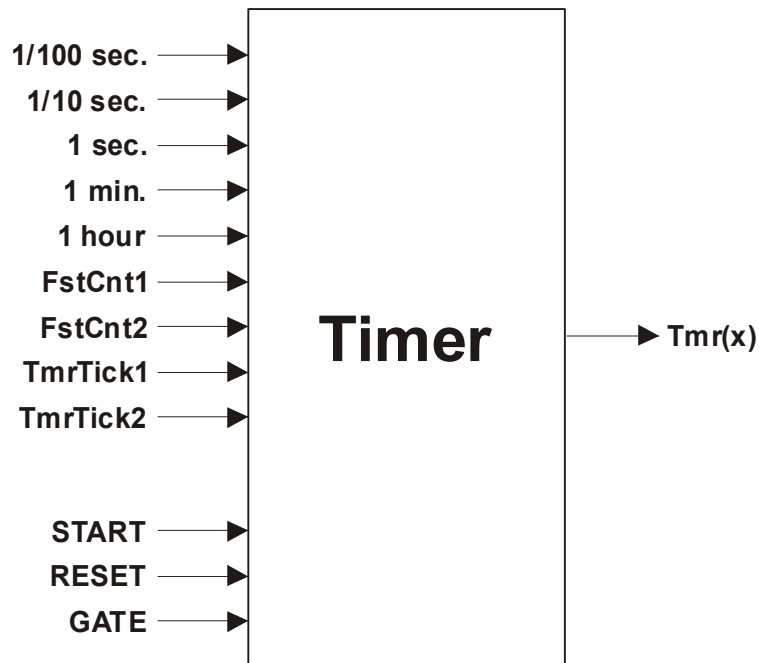
When a timer is used as a coil, 3 different input types are defined:

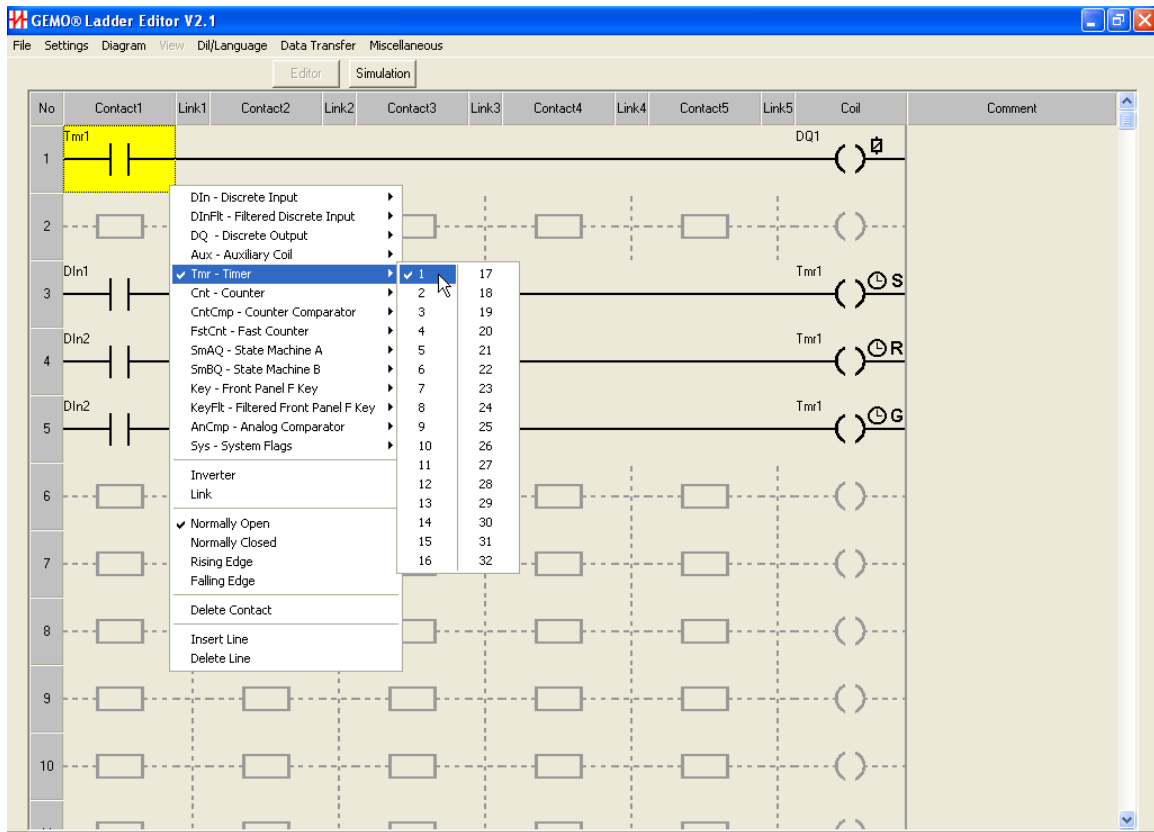
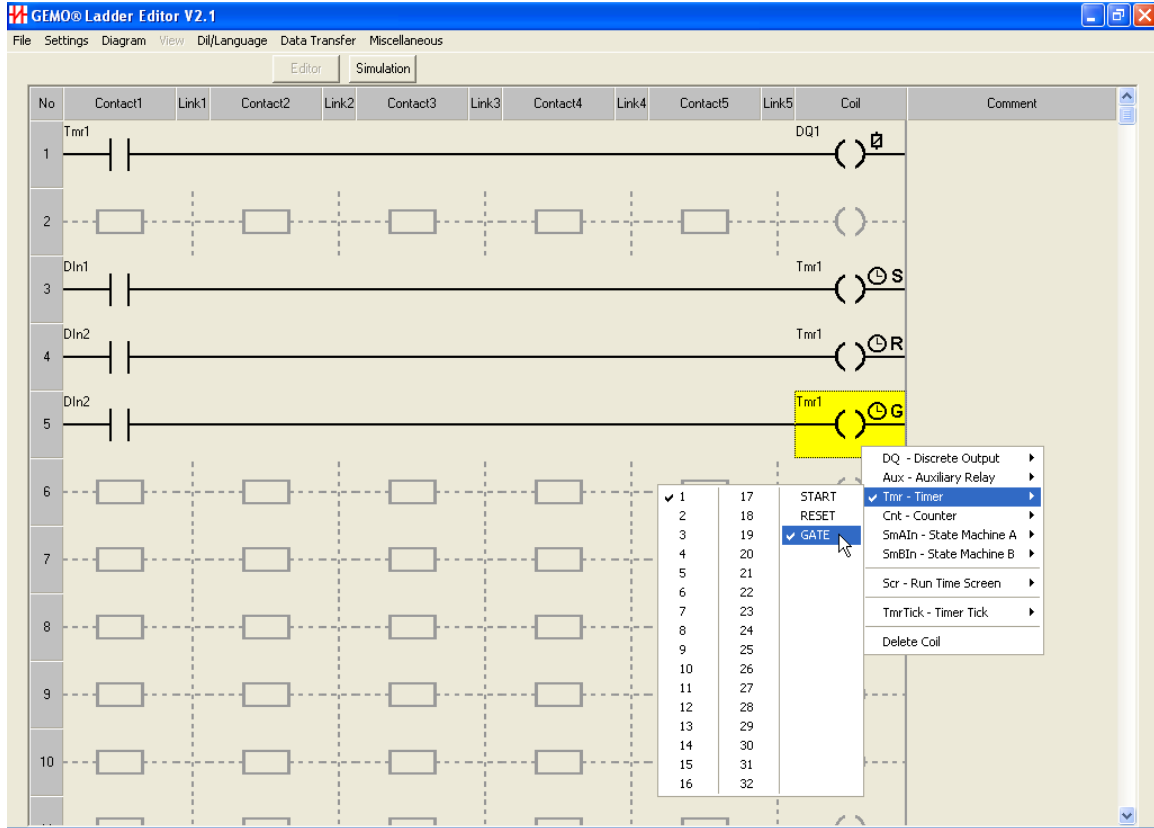
- **START Input:** Starts a timer (not for Mode E). Function of START input differs according to selected mode of operation.
- **RESET Input:** If RESET input is ON, timer is reset, output of timer becomes OFF (not for Mode E).
- **GATE Input:** For all modes of operation, if GATE input in ON, timer stops counting but does not reset (it freezes).

Each timer has 2 preset values; Preset A and Preset B. Preset B is not defined for some modes of operation. Both Preset A and Preset B is user settable (programmable) if included in the list of LCD designer menu.

Timers may be **retentive** if set in the Timer Parameters Screen. Refer to Retention section for more detail. Use retention carefully. Study all conditions that may happen during/after a power failure and/or during/after power is on and take precautions.

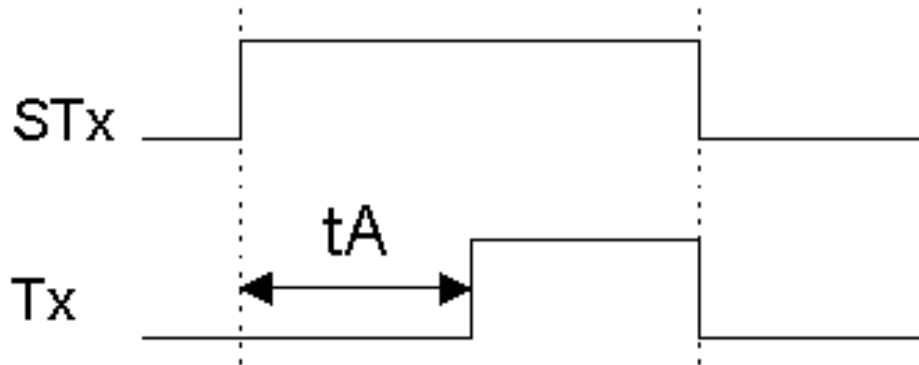
Each timer may have a different mode of operation with a separate/independent time base. Modes of operation defined below. Tx or Tmr(x) means Output of Timer x, STx means START input of Timer x and RTx means RESET input of Timer x.





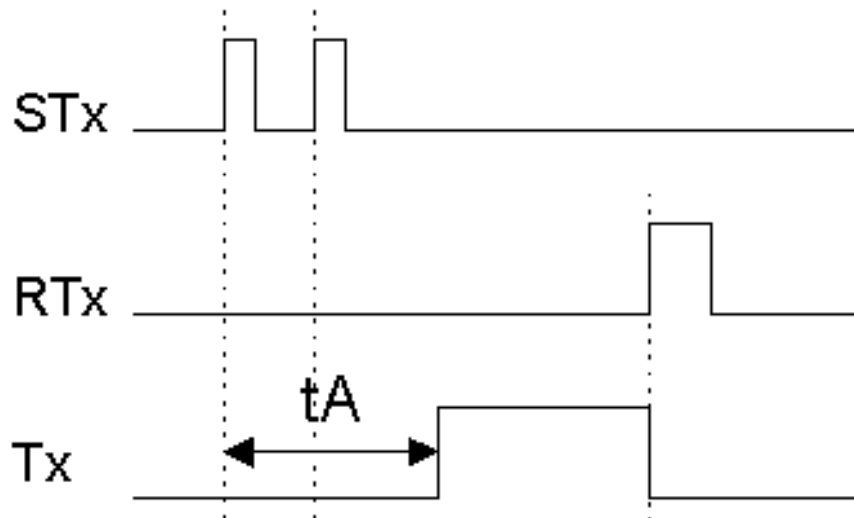
7.6.1 Mode A: ON Delay

Tmx becomes ON "tA" after START input is ON. Tmx is OFF when START input is OFF. Tmx is OFF when RESET input is ON.



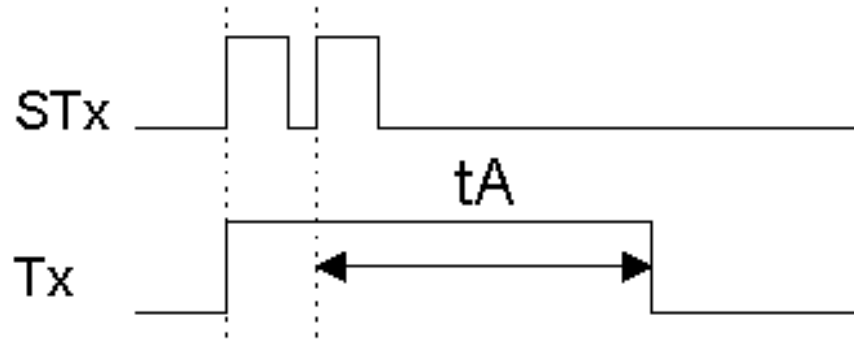
7.6.2 Mode B: Pulsed Delay, OFF with RESET

Tmx becomes ON "tA" after START input is triggered (OFF > ON). START input can not retrigger timer until it is reset with RESET input. Tmx is OFF when RESET input is ON.



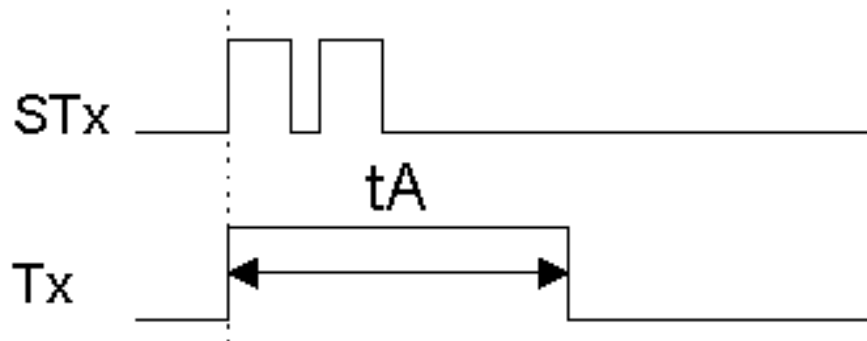
7.6.3 Mode C: Retriggerable One Shot

Tmx becomes ON when START input is triggered (OFF > ON) and becomes OFF after "tA". START input can retrigger when Tmx is ON. Tmx is OFF when RESET input is ON.



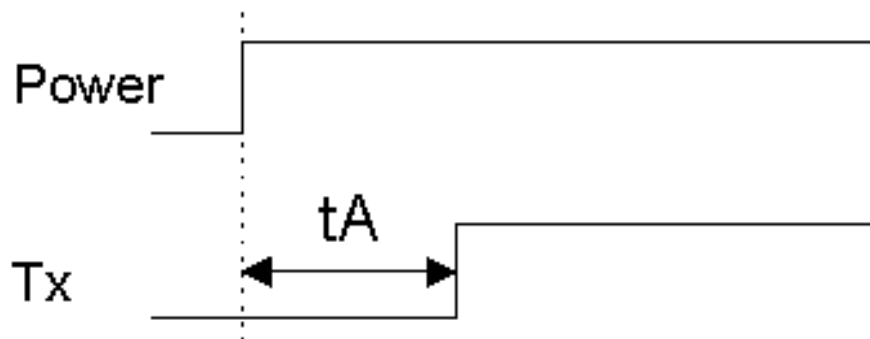
7.6.4 Mode D: Non-retriggerable One Shot

Tmx becomes ON when START input is triggered (OFF > ON) and becomes OFF after "tA". START input can not retrigger when Tmx is ON. Tmx is OFF when RESET input is ON.



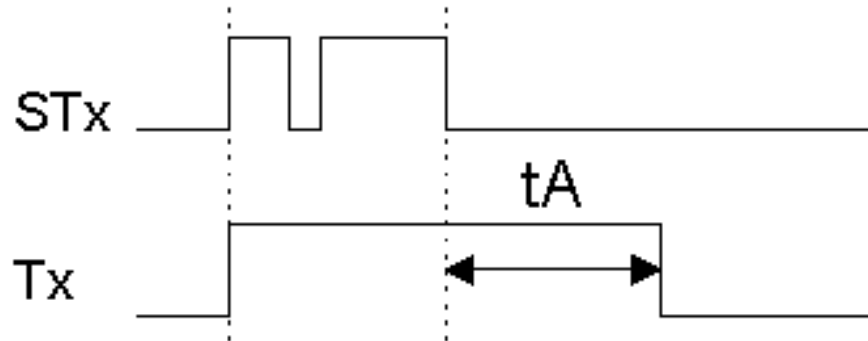
7.6.5 Mode E: Delay after Power ON

Tmx becomes ON "tA" after Power ON. START input does not trigger timer. RESET input does not reset timer.



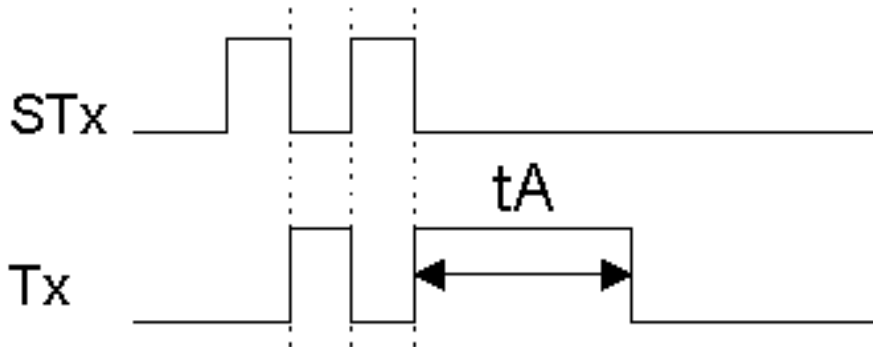
7.6.6 Mode F: OFF Delay

Tmr_x becomes ON when START input is ON. Tmr_x becomes OFF "t_A" after START input is triggered (ON > OFF). Tmr_x is OFF when RESET input is ON.



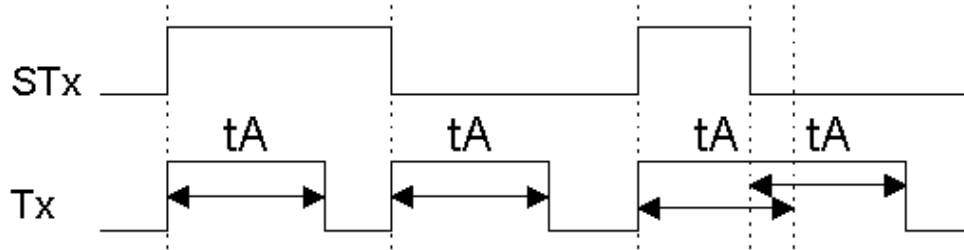
7.6.7 Mode G: One Shot after OFF

Tmr_x becomes ON when START input is triggered (ON > OFF) and becomes OFF after "t_A". Tmr_x is OFF when START input is ON. Tmr_x is OFF when RESET input is ON.



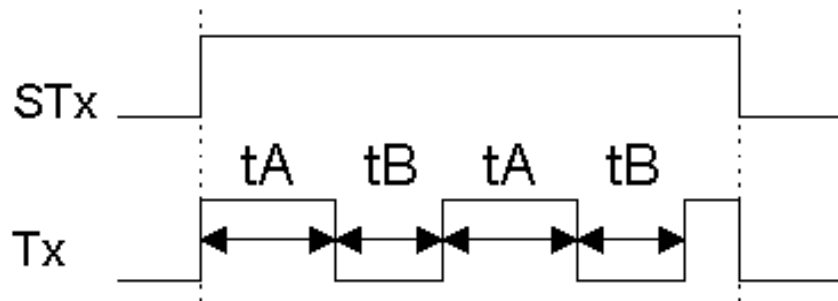
7.6.8 Mode H: One Shot after ON and OFF

Tmr_x becomes ON when START input is triggered (OFF > ON) or (ON > OFF) and becomes OFF after "t_A". START input can retrigger when Tmr_x is ON. Tmr_x is OFF when RESET input is ON.



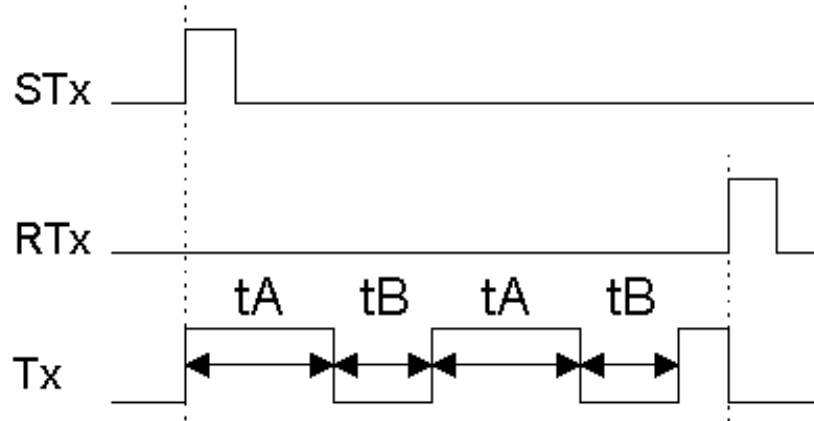
7.6.9 Mode I: Flashing with START

Tmr_x is periodically first ON for "t_A" and then OFF for "t_B" when START input is ON. If "t_B" is set to 0, then t_B=t_A (symmetrical ON/OFF). Tmr_x is OFF when START input is OFF. Tmr_x is OFF when RESET input is ON.



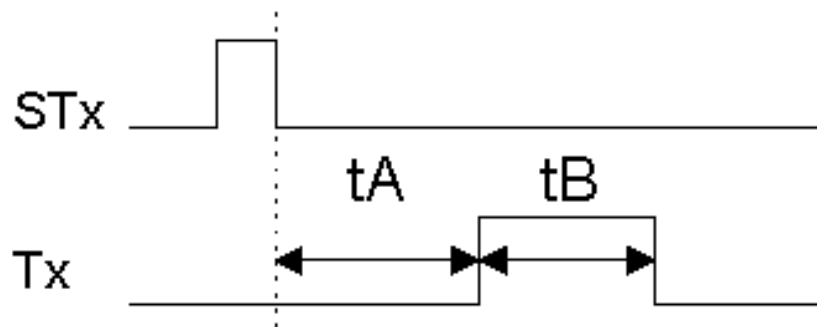
7.6.10 Mode J: Flashing with START/RESET

Tmx is periodically first ON for "tA" and then OFF for "tB" after START input is triggered (OFF > ON). If "tB" is set to 0, then tB=tA (symmetrical ON/OFF). Tmx is OFF when RESET input is ON.



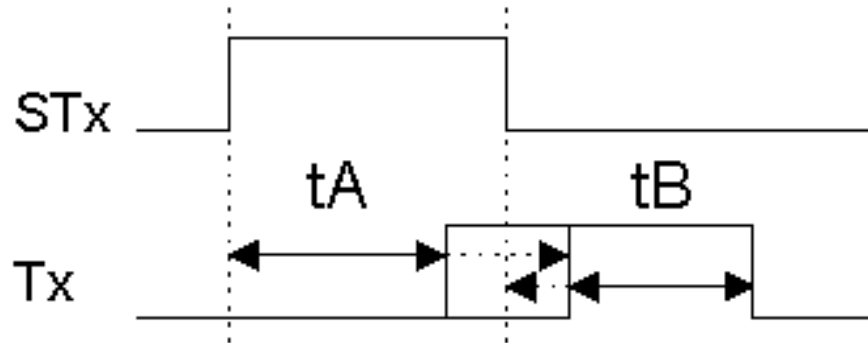
7.6.11 Mode K: Delayed One Shot after OFF

Tmx is first ON after "tA" and then OFF after "tB" when START input is triggered (ON > OFF). START input does not retrigger before "tB" elapses. Tmx is OFF when RESET input is ON.



7.6.12 Mode L: Independent ON Delay, OFF Delay

Tmr_x is ON "t_A" after START is triggered (OFF>ON). Tmr_x is OFF "t_B" after START is triggered (ON>OFF). Tmr_x may become ON after START input is triggered (ON>OFF). (START ON duration + t_B)>t_A in order that Tmr_x may become ON. Tmr_x is OFF when RESET is ON.

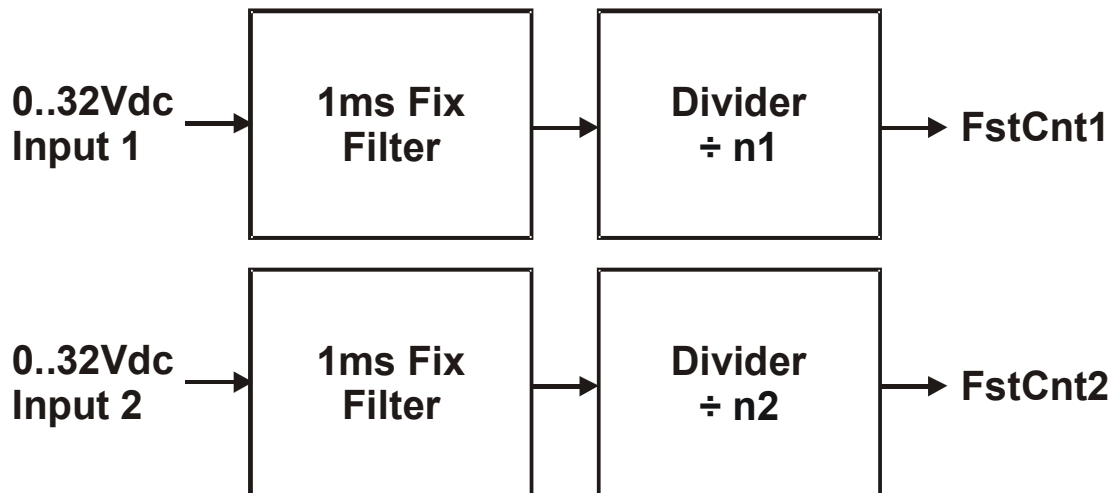


7.7 Fast Input Counters

Fast Input Counters is used to scale fast inputs (faster than scan time).

There exist 2 Fast Input Counters; FstCnt1 and FstCnt2. FstCnt1 scales physical Digital Input Input1 and FstCnt2 scales physical Digital Input 2.

Block diagram of a fast counter is shown below. A physical input (In_x) is filtered by a 1ms fix filter. Filtered signal is applied to a divider. The divisor value (Preset) for each fast input counter is determined from Fast Input Settings Screen. These values are determined during design time.



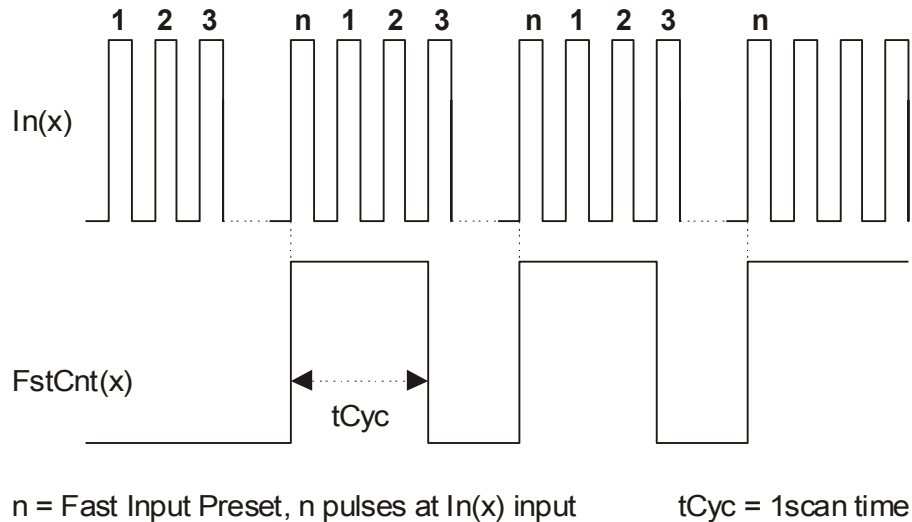
A Fast Input Counter output is periodic. It periodically counts "Preset" number of rising edges of In_x and FstCnt(x) becomes ON (pulse) for 1 Scan Time. 'Duration of "Preset" number of Rising edges of In_x should be greater than 2xScan time so

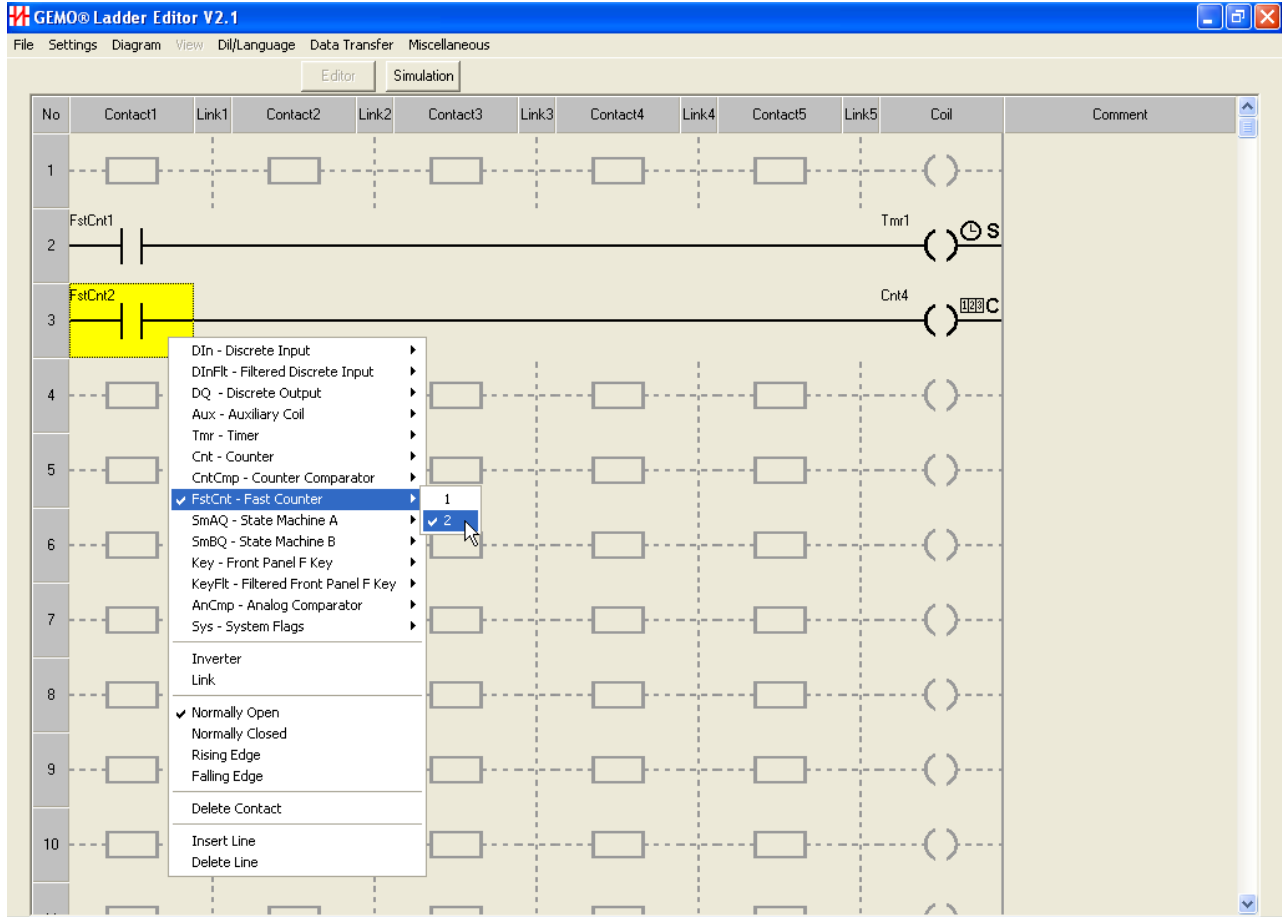
that FstCnt(x) shall be ON and OFF periodically.', otherwise the output of fast input counter is still too fast to be processed by the scan of diagram.

Because of the 1ms fix filter, theoretical maximum signal frequency at the physical input is 500Hz with 50% duty cycle. Filter requires 1ms ON and 1ms OFF level. Prefer to apply a maximum of 400Hz with 50% duty cycle.

Please refer to Technical Specification for timing information. Be sure that Preset value is high enough so that it can successfully scanned in real time.

A fast Input Counter is used as a contact in ladder diagram.





7.8 Counters

Click Settings -> Counters to access to Counter Parameters screen. User can select function (type) and default Preset values of each counter in this screen.

A counter may function in 2 modes (type of a counter); Up, down. When “Up” is selected, counter increments one count for each count pulse. Counter value is set to 0 and counter output becomes OFF when a RESET pulse is applied. Counter output is ON when counter value is greater or equal to its preset value.



When counter type is selected as “Down”, counter decrements one count for each count pulse. Counter value is set to its preset value and counter output

becomes OFF when a RESET pulse is applied. Counter output is ON when counter value is equal to 0.

Each counter is 16 bit (0..65535) wide. A counter does not count below 0. If a count pulse is applied when the counter value is 0 and counting direction is “down”, counter value remains as 0. Similarly, a counter does not count above 65535. If a count pulse is applied when the counter value is 65535 and counting direction is “up”, counter value remains as 65535.

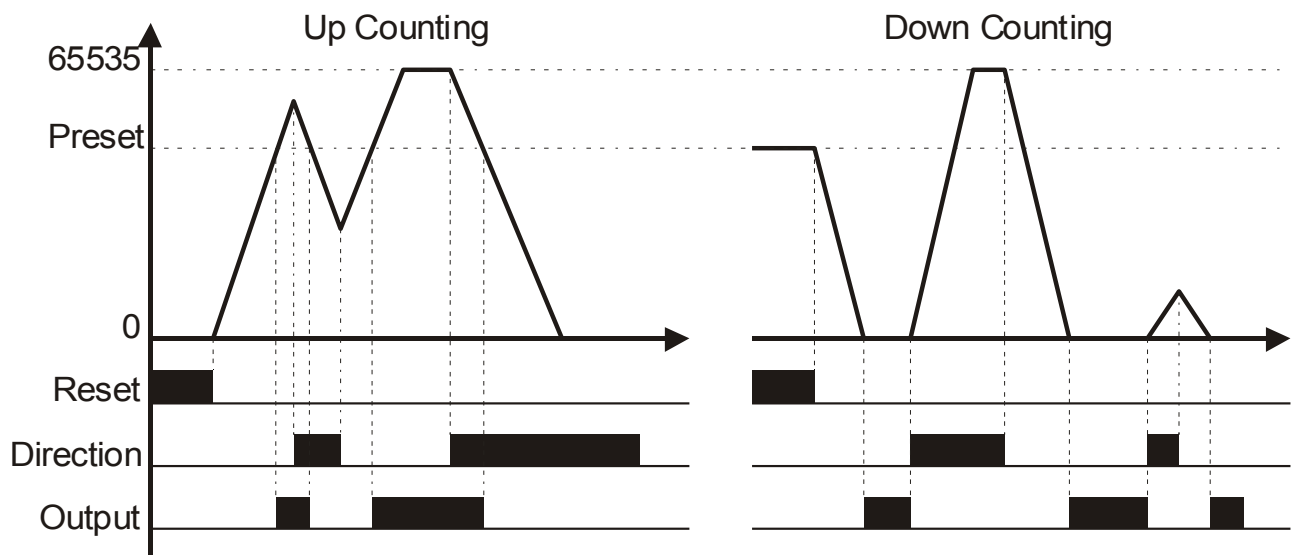
When a counter is used as a coil, 3 different input types are defined:

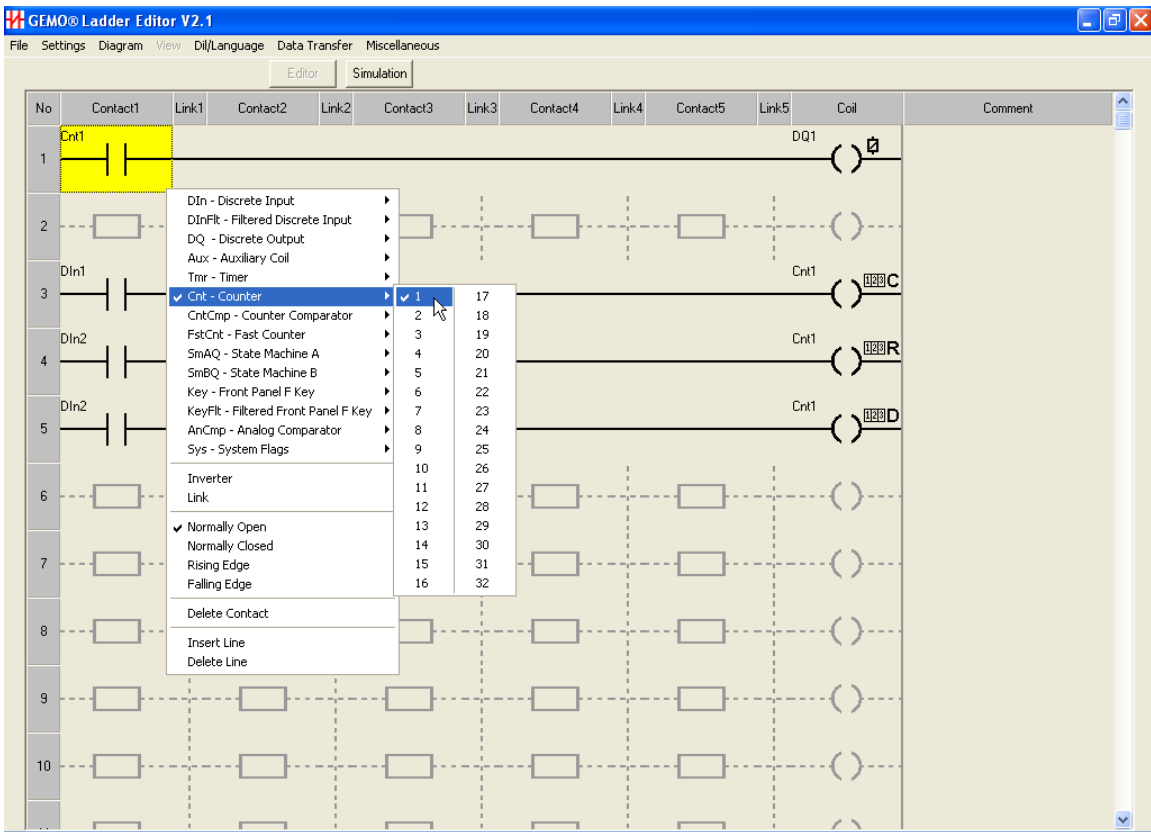
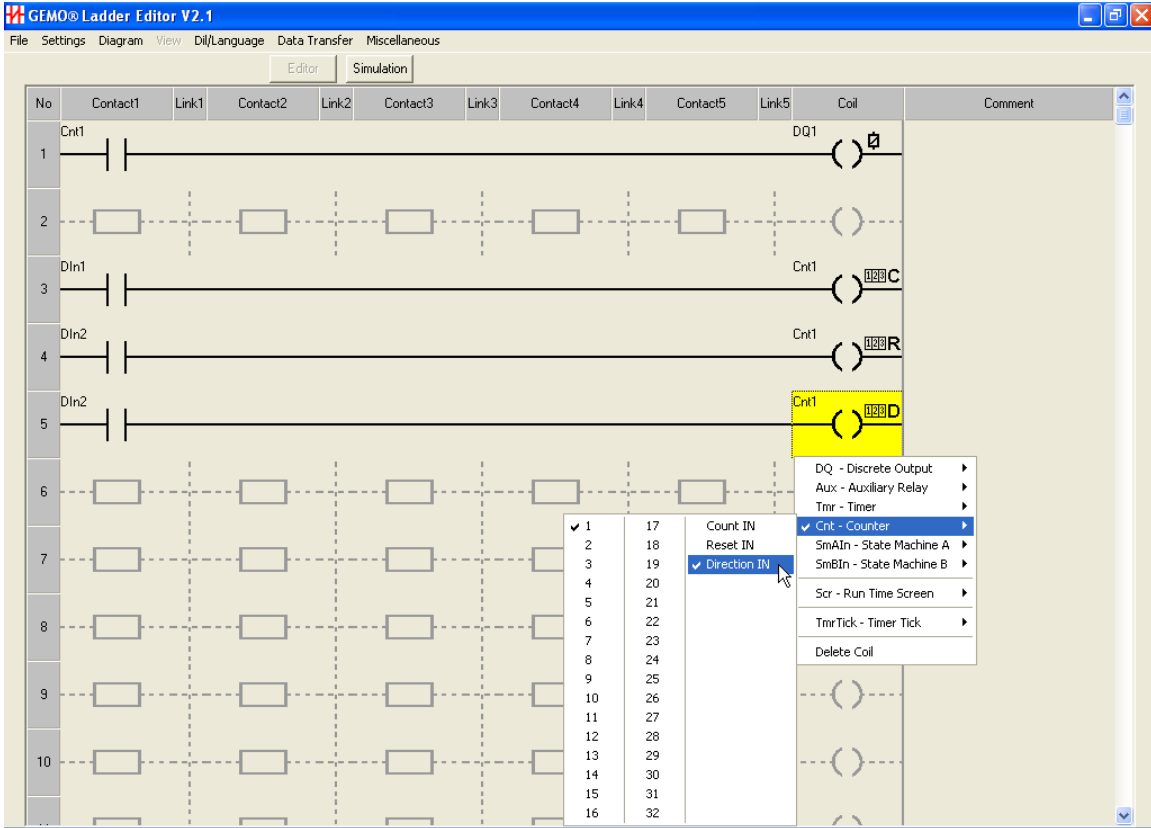
- **Count Input:** Counter is incremented or decremented one count when this input changes state OFF -> ON.
- **Reset Input:** When this input is ON, the output of counter is OFF and counter value is set to 0 if type is “Up” or counter value is preset value if type is “Down”.
- **Direction Input:** When this input is OFF, counter increments if type is “Up” and decrements if type is “Down”. When this input is ON, counter decrements if type is “Up” and increments if type is “Down”. If this input is not used, it is accepted as OFF.

Each counter has a single and unique preset value. Counter preset value is user settable (programmable) if included in the list of LCD menu designer.

Each timer may have a different type of operation with a separate and unique preset value.

Counters may be **retentive** if set in the Counter Parameters Screen. Refer to Retention section for more detail. Use retention carefully. Study all conditions that may happen during/after a power failure and/or during/after power is on and take precautions.

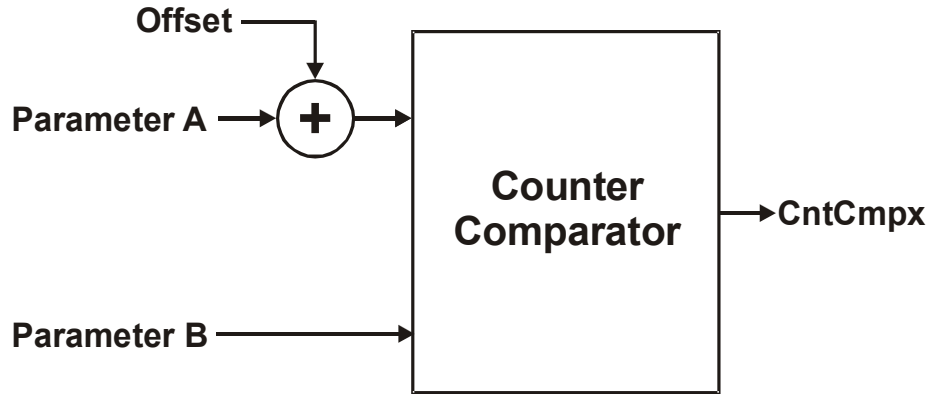




7.9 Counter Comparators

Counter Comparator Parameters and Counter Comparator Presets are adjusted in Counter Comparator Parameters Screen.

Block diagram of a counter comparator is shown below.



A counter comparator compares 2 input parameters (Parameter A and Parameter B) according to a predefined logical operator and result of the comparison is the ON/OFF state of CntCmpx contact in the ladder diagram.

One of the followings shall be an input parameter;

- **Cnt:** Actual value of any counter.
- **CntPrst:** Preset value of any counter.
- **CntCmpPrst:** Any Counter Comparator Preset Value.

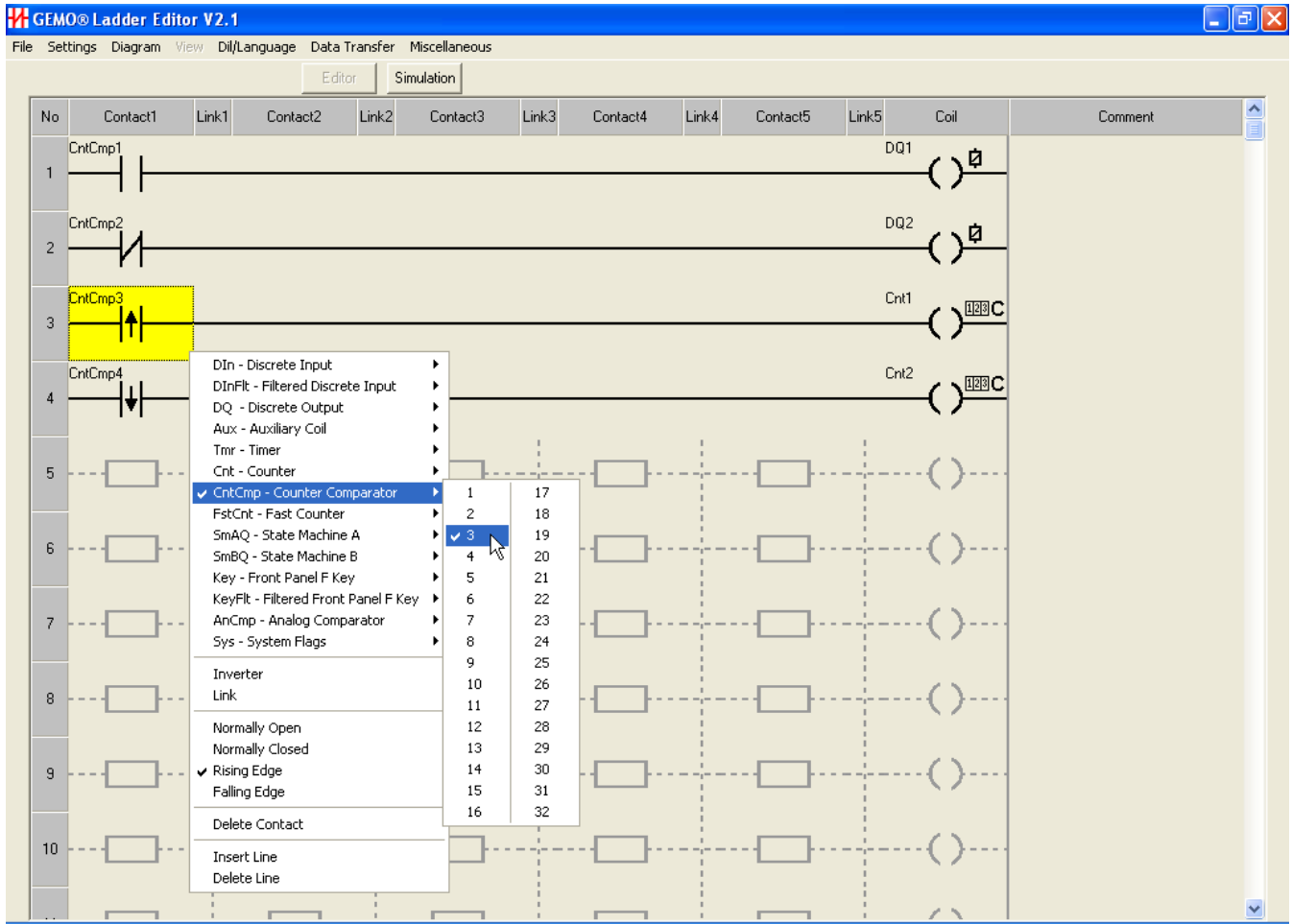
Counter Comparator Presets are not specific to comparators. A counter comparator preset shall be a parameter of many comparators. A comparator shall use same counter comparator preset as Parameter A and Parameter B, there is no limitation. Counter Comparator Presets shall be adjusted via front panel of device during run time.

An offset value is added to Parameter A before comparison. Offset value is determined during design time and can not be adjusted via front panel of device during run time. Offset value is specific to a comparator.

One of the followings shall be the logical operator of a counter comparator;

- **>** : CntCmpx is ON if (Parameter A + Offset) is greater than (Parameter B).
- **>=** : CntCmpx is ON if (Parameter A + Offset) is greater than or equal to (Parameter B).
- **=** : CntCmpx is ON if (Parameter A + Offset) is equal to (Parameter B).

- \neq , $!$: CntCmpx is ON if (Parameter A + Offset) is not equal to (Parameter B).
- $<$: CntCmpx is ON if (Parameter A + Offset) is less than (Parameter B).
- \leq : CntCmpx is ON if (Parameter A + Offset) is less than or equal to (Parameter B).



7.10 Front Panel F Keys

Processing block diagram of a Front Panel F Key is shown below.

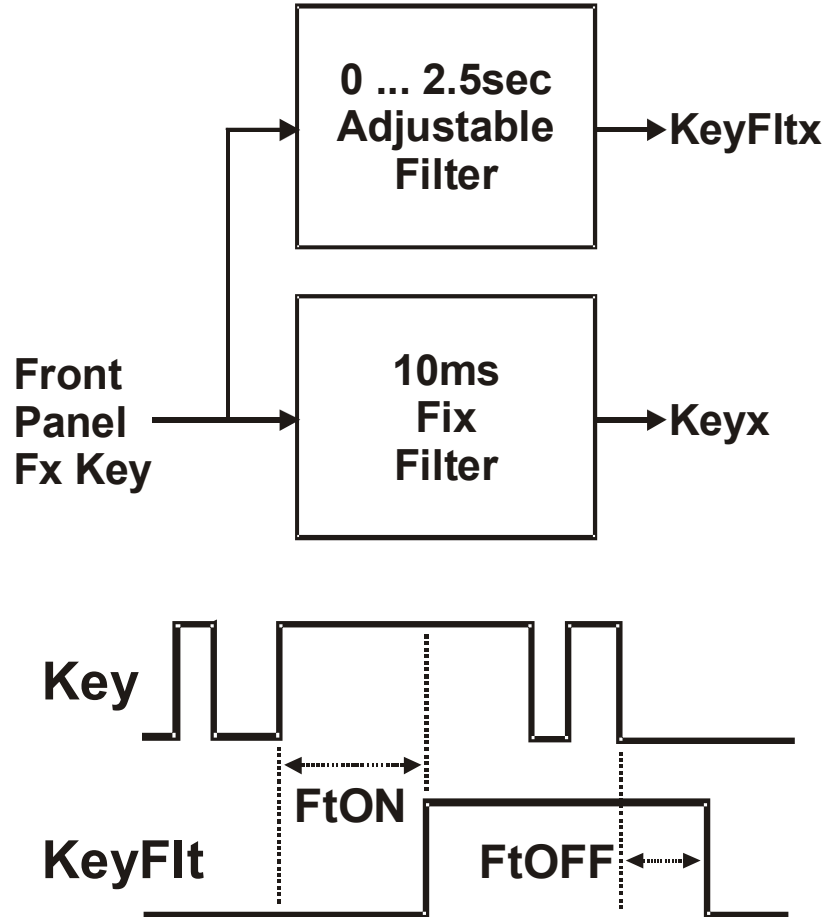
Signal produced by a key is filtered by a 10ms fixed filter and the filtered signal is used in ladder diagram as Key contact.

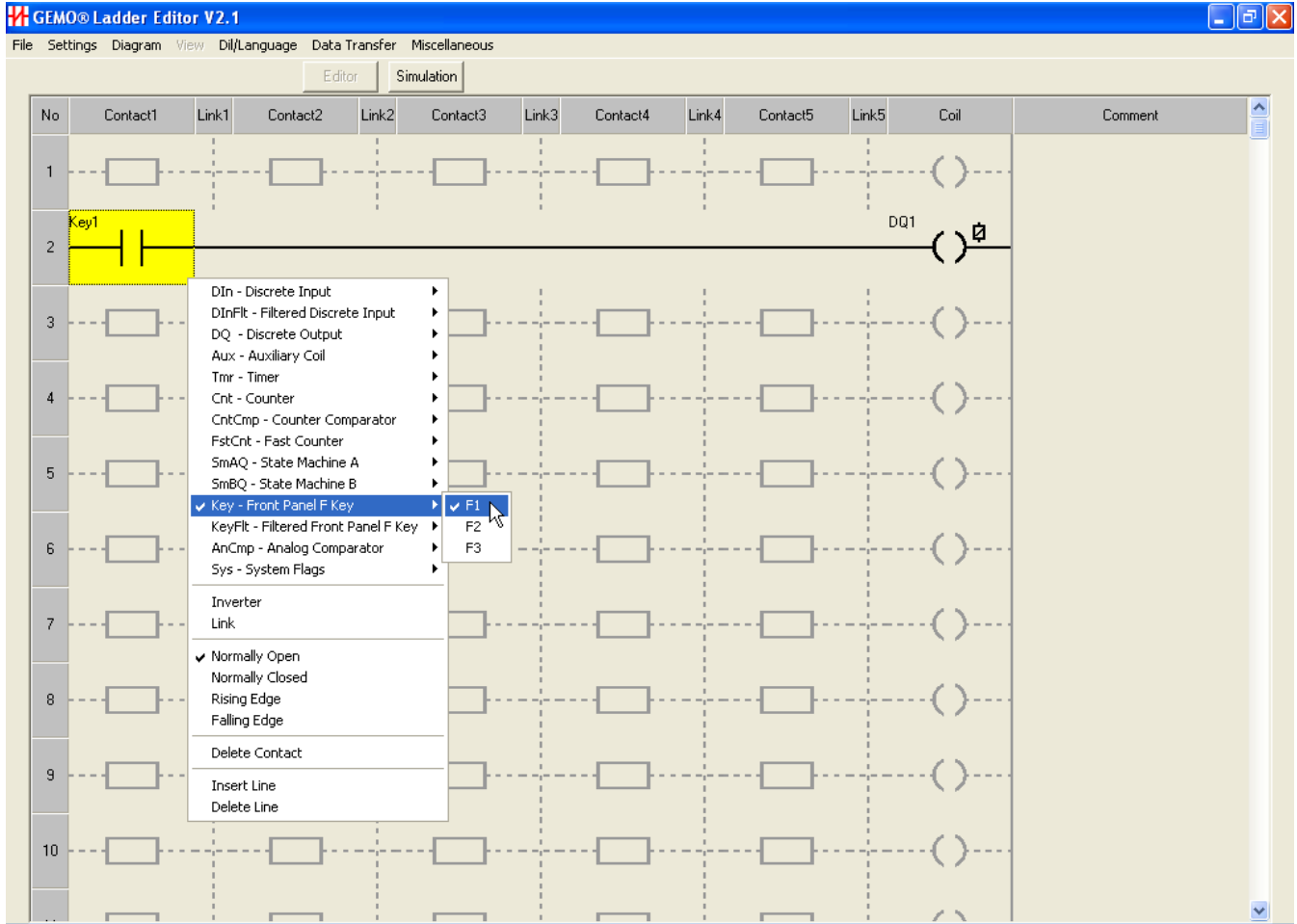
Signal produced by a key filtered by an adjustable 0...2.5 sec filter and the filtered signal is used in ladder diagram as KeyFlt (filtered Front Panel F Key) contact. ON and OFF filter time may be adjusted separately via Front Panel F Keys Screen.

Front Panel F Key has 2 functions. During parameter entry, it is used as up, down, shift right key. During I/O States Screen or Run Time Screens, F Key

function is active. During parameter entry, F function is passive and F key reads OFF.

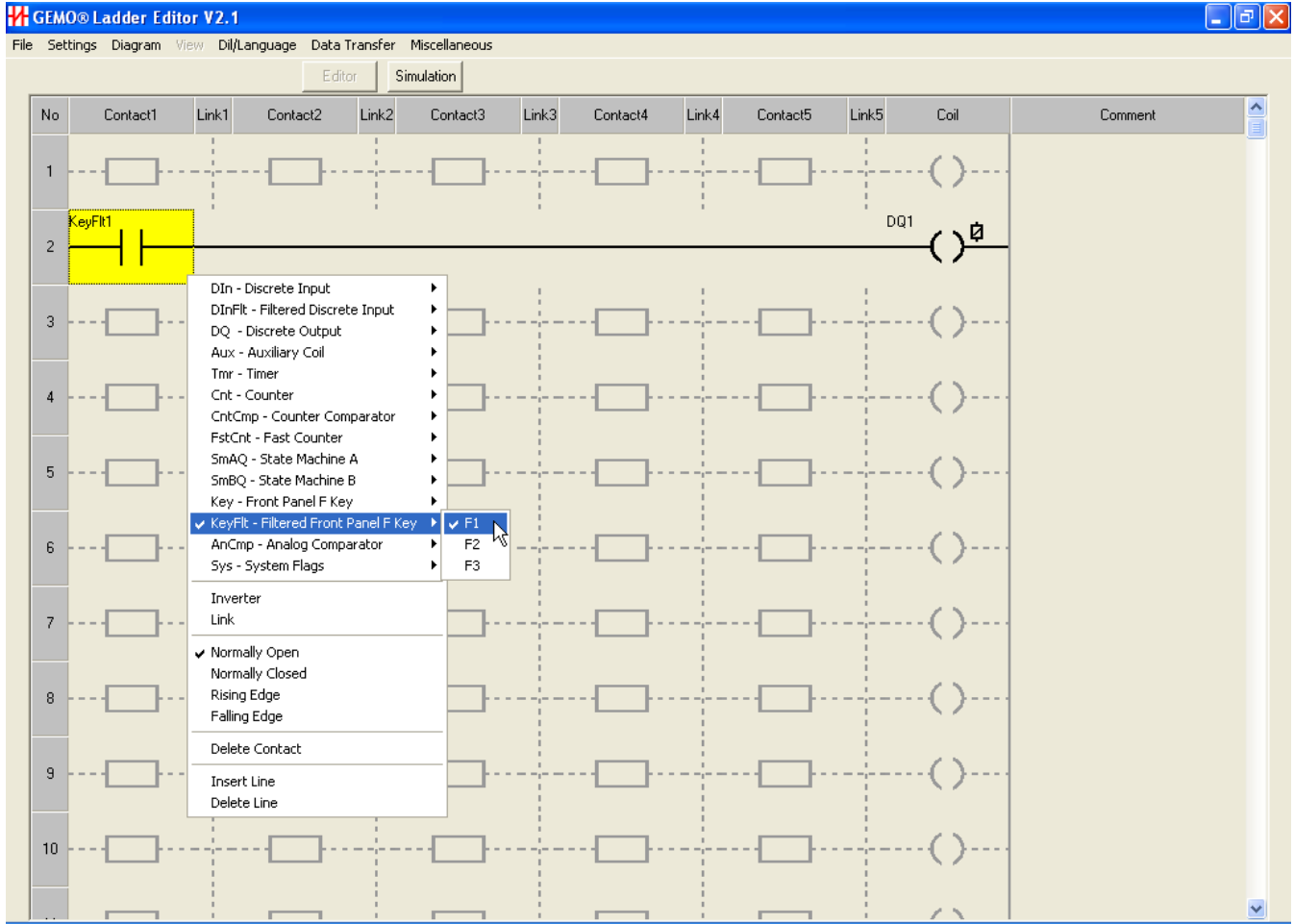
Filtered input waveform is shown below.





7.11 Filtered Front Panel F Keys

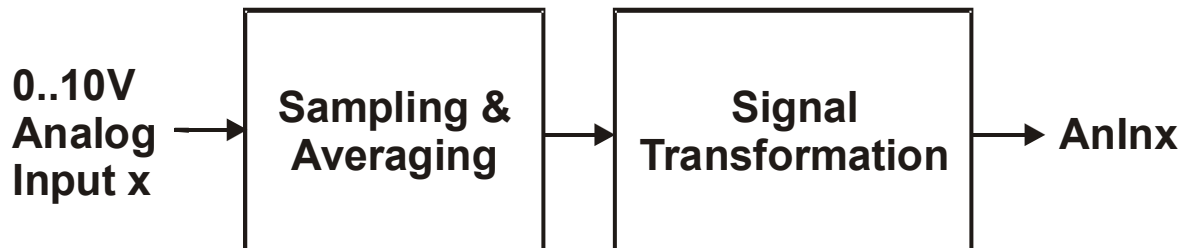
Refer to Front Panel F Keys section for details.



7.12 Analog Inputs

7.12.10...10V Analog Inputs

There exist 4 defines 0...10V Analog Inputs. Analog input configuration is optional. Refer to Device Configurations section for detail.



Parameters settings of 0...10V Analog Inputs are done via 0...10V Analog Input Parameters Screen. Following parameters are defined for 0...10V Analog Inputs.

- **0V Reading Value:** This value is the transformed signal value that will be applied to an analog comparator when 0V is applied to an analog input. Range is -999...1000. Refer to the examples below.
- **10V Reading Value:** This value is the transformed signal value that will be applied to an analog comparator when 10V is applied to an analog input. Range is -999...1000. Refer to the examples below.
- **Samples:** Determines number of samples to average before transformation. As number of samples increases, signal response time increases. Averaging is a basic method to suppress noise. Prefer to select largest sampling value that suits your application.
- **LCD Format:** Determines how the value of the selected analog input will appear on LCD (the decimal digit position).

Signal transformation is mapping 0...10V scale to another increasing or decreasing scale (with an offset) linearly. 2 parameters are used for this transformation; 0V Reading Value and 10V Reading Value.

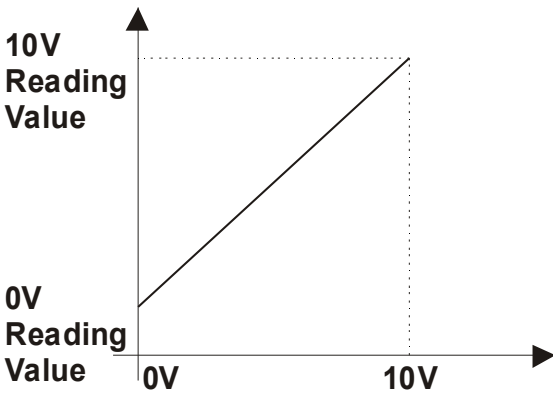
- **Example 1:** Let 0V Reading Value is 100 and 10V Reading Value is 500. Then the transformed value is 300 when 5.0V is applied to analog input.
- **Example 2:** Let 0V Reading Value is -200 and 10V Reading Value is 700. Then the transformed value is 250 when 5.0V is applied to analog input.
- **Example 3:** Let 0V Reading Value is 400 and 10V Reading Value is 200. Then the transformed value is 300 when 5.0V is applied to analog input.
- **Example 4:** Let 0V Reading Value is -400 and 10V Reading Value is -600. Then the transformed value is -500 when 5.0V is applied to analog input.

0 Reading Value may be greater (decreasing) or less (increasing) than 10V Reading Value. The transferred values are displayed in Analog Inputs sub screen, at the right hand side of bars, during simulation.

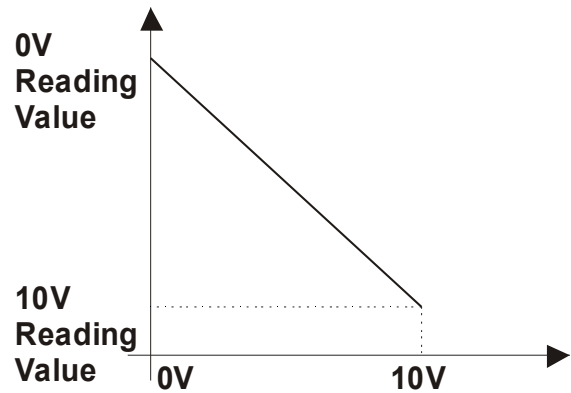
The graphical representation of transformation is shown below.

If applied analog signal is greater than 10V, the measurement is accepted as 10V, and the transformation is done for 10V.

Increasing
10V Reading Value > 0V Reading Value



Decreasing
0V Reading Value > 10V Reading Value



7.12.2 PTC Temperature Sensor Inputs

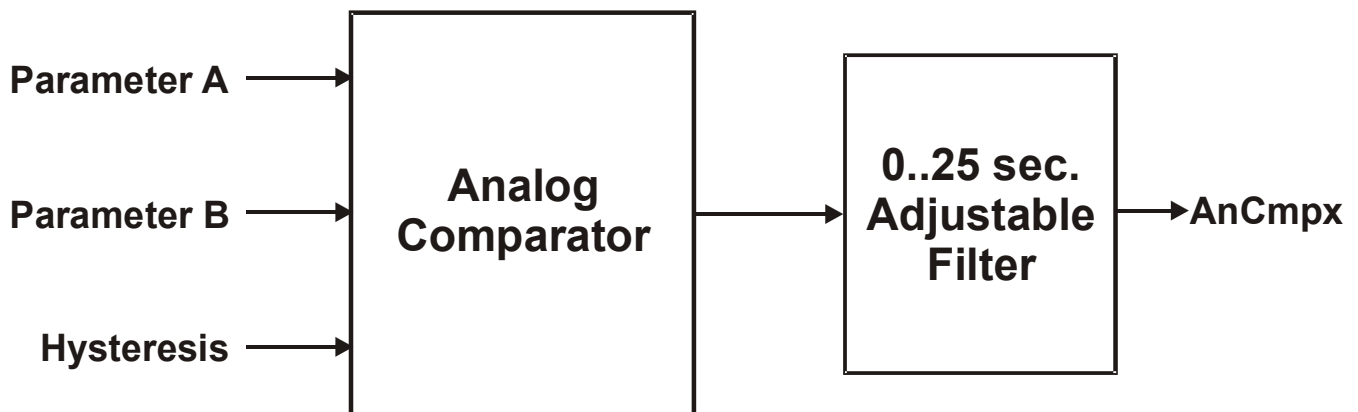
There exist 2 PTC Temperature Sensor Inputs. Sensors are ordered separately. Refer to Device Configurations section for detail.

A PTC temperature sensor scale is $-50\dots150^{\circ}\text{C}$. Scale is Centigrade. Always use ErrPTCx system flags if PTC sensor input is used. ErrPTCx system contacts reports sensor failure or out of range (scale) measurement. When ErrPTCx system contact is active, PTC sensor measurement value is not valid.

7.13 Analog Comparators

Analog Comparator Parameters, Analog Comparator Presets and Analog Comparator Hysteresis values are adjusted in Analog Comparator Parameters Screen.

Block diagram of an analog comparator is shown below.



An analog comparator compares 2 input parameters (Parameter A and Parameter B) according to a predefined logical operator and result of the

comparison (after filtered) is the ON/OFF state of AnCmpx contact in the ladder diagram.

One of the followings shall be an input parameter;

- **PTC:** One of the PTC temperature sensor readings (real time measured temperature value).
- **AnIn:** Measured and transformed value of one of the .0-10V analog inputs
- **AnCmpPrst:** Any Analog Comparator Preset Value.

Analog Comparator Presets are not specific to comparators. An analog comparator preset shall be a parameter of many comparators. A comparator shall use same analog comparator preset as Parameter A and Parameter B, there is no limitation. Similarly Analog Inputs and Analog Comparator Hysteresis shall be a parameter of many comparators. Analog Comparator Hysteresis and Analog Comparator Presets shall be adjusted via front panel of device during run time.

The LCD format of all parameters (Parameter A, Parameter B and Hysteresis) of a specific analog comparator should be the same, otherwise simulation and download is not allowed. LCD format determines how the value of the selected parameter will appear on LCD (the decimal digit position). Actually the comparison is done in 16 bit integer format. But for correct use, wrong LCD format assignment is not allowed.

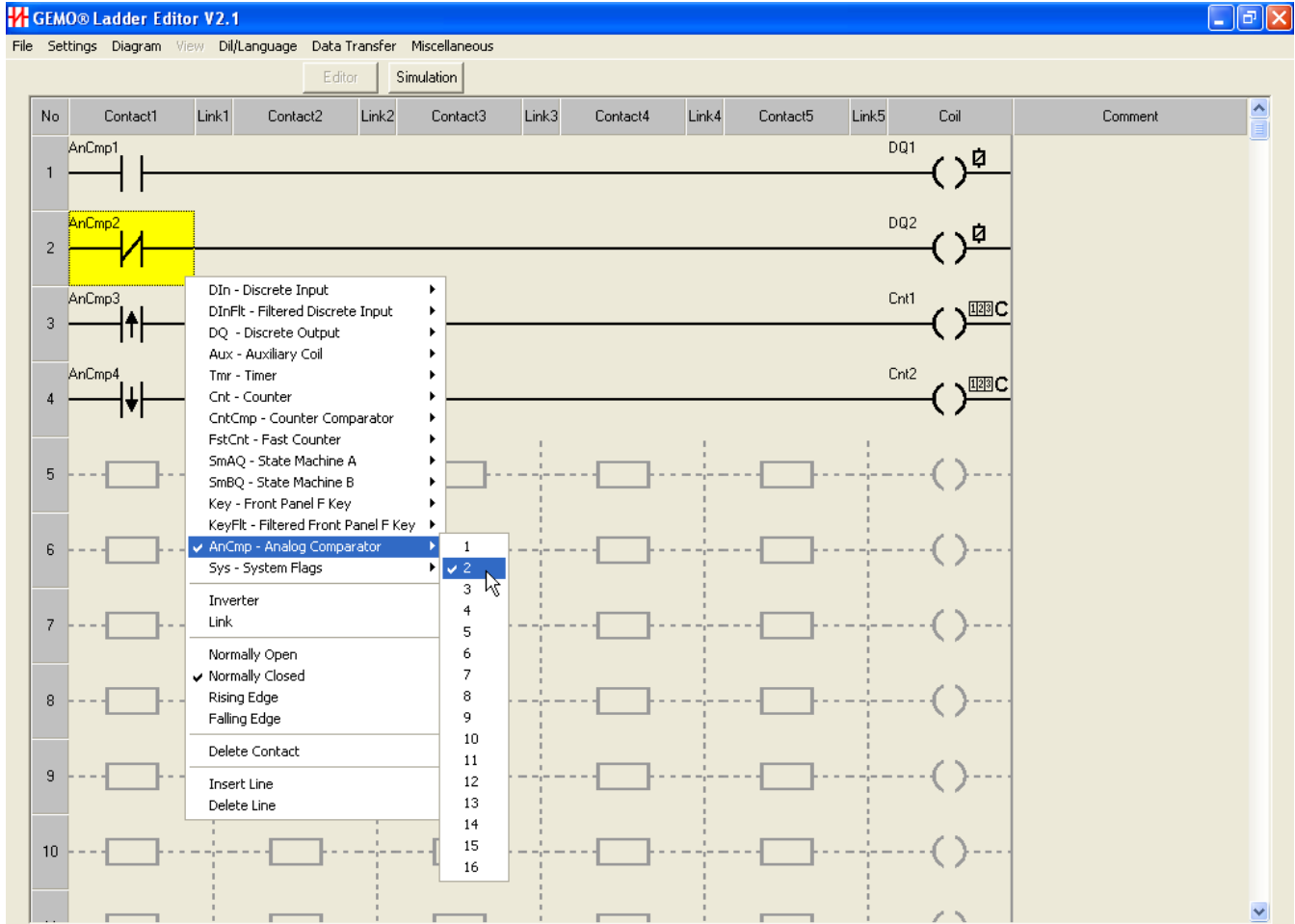
Hysteresis is defined only for (+)Hys and (-)Hys operators, and is not used at other logical operations.

One of the followings shall be the logical operator of an analog comparator;

- **>** : AnCmpx is ON if (Parameter A) is greater than (Parameter B).
- **>=** : AnCmpx is ON if (Parameter A) is greater than or equal to (Parameter B).
- **=** : AnCmpx is ON if (Parameter A) is equal to (Parameter B).
- **<>, !=** : AnCmpx is ON if (Parameter) is not equal to (Parameter B).
- **<** : AnCmpx is ON if (Parameter A) is less than (Parameter B).
- **<=** : AnCmpx is ON if (Parameter A) is less than or equal to (Parameter B).
- **(+)Hys:** AnCmpx is ON if (Parameter A) is greater than or equal to (Parameter B + Hysteresis). AnCmpx is OFF if (Parameter A) is less than or equal to (Parameter B). This operator, as an example, may be used for cooling function.
- **(-)Hys:** AnCmpx is ON if (Parameter A) is less than or equal to (Parameter B - Hysteresis). AnCmpx is OFF if (Parameter A) is greater than or equal to (Parameter B). This operator, as an example, may be used for heating function.

The comparison result is applied to a filter. The filter ON and OFF times shall be determined separately during design time via Analog Comparator Parameters Screen. ON and OFF times shall be 0...25 seconds.

If any Analog Input or PTC input, that is not defined (for example; a device having no analog input) or can not be measured (for example; PTC sensor is not connected, or extension module is not connected), is connected to an analog comparator, the output of the comparator is always forced to OFF.

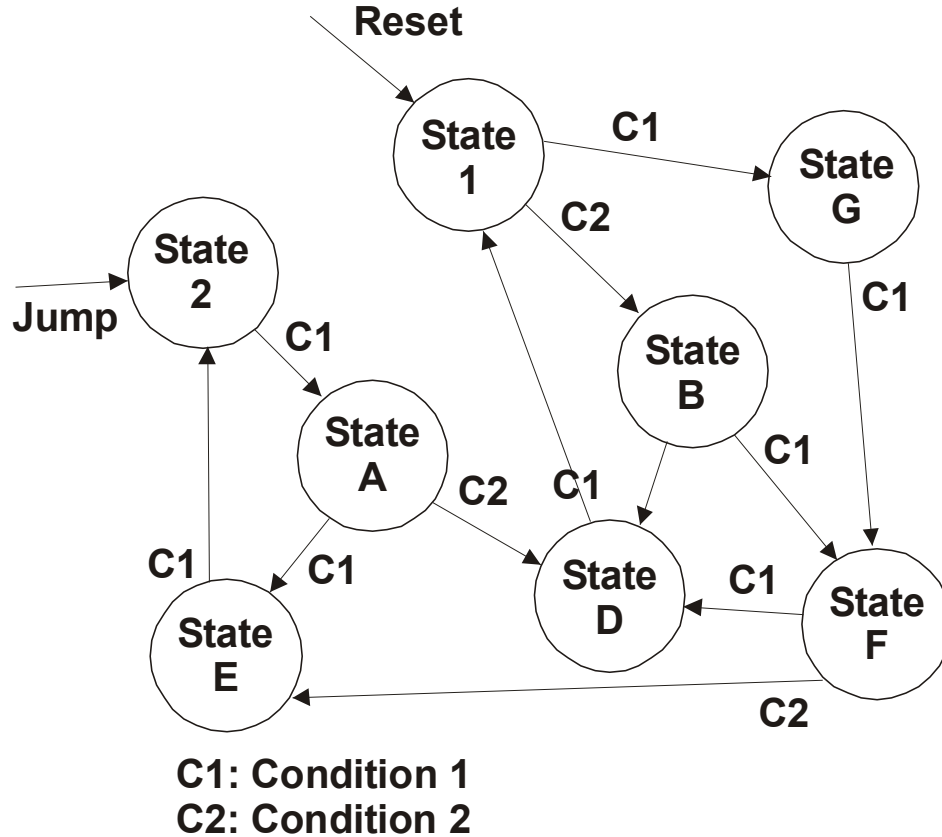


7.14 State Machines

Parameter entry of State Machines is done in State Machine Design Screen.

State Machine is a useful programming tool especially for sequential type event handling. A built in state machine saves programming resources and reduces programming time. It eliminates race conditions because transitions are deterministic.

Below a sample state diagram is given. As seen in the diagram, there exist complex cases that should be handled. Also, transitions are not trivial to handle. To draw classical type of ladder diagrams for state handling is not so easy. It is time consuming, it requires a lot of resources, it is difficult to test and trace execution. Race conditions remain as pitfalls during lifetime of the application.



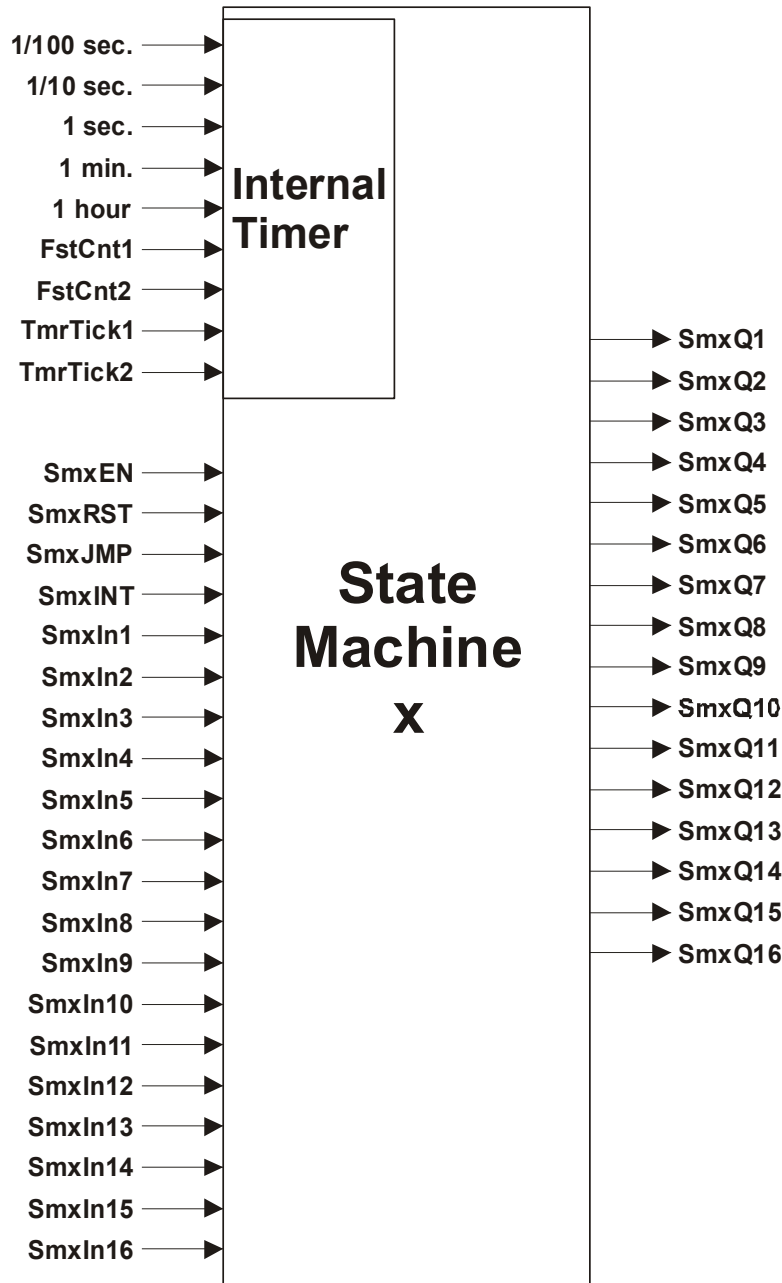
AR2 introduces State Machines, each having 48 states, to overcome many of such problems. AR2 has 2 independent and identical state machines; State Machine A and State Machine B. Each state machine has its own inputs/outputs and runs independently. So it is possible to manage 2 independent state handling functions at the same time in as single device.

A block diagram is given below for an AR2 state machine.

Each AR2 state machine has a built in timer. This single timer has different Preset and times base settings for each state separately and independently. This feature shall eliminate to use external timers for timed event handling, hence eliminating complexity and saving resources. Preset value of each state shall be adjusted via front panel. Also Preset and Actual value of each timer shall be displayed on LCD during run time.

Internal timer shall also count events when time base is selected as FstCnt1 and FstCnt2 (Fast Input Counters), and TmrTick1 and TmrTick2 (Timer Ticks). So, internal timer may be used as a counter, eliminating the use of an external

counter in many cases. When state machine jumps to a new state, internal timer is loaded with the Preset and time base of the new state, and starts counting down to 0.



An AR2 State Machine has inputs and outputs. Inputs are used in Coil Column in ladder diagram. Inputs are;

- **SmxEN:** This input enables all State Machine functions when it is ON. It should be kept ON during operation. If it is OFF no input except SmxRST is accepted and all outputs forced to OFF.

- **SmxRST:** This input is the RESET input. It is asynchronous. State machine jumps to State 1 when SmxRST is ON regardless of the current State number. All outputs at State 1 is OFF and can not be turned to ON at the State Machine Table. SmxRST is more prior than SmxJMP.
- **SmxJMP:** This input is the JUMP input. It is asynchronous. State machine jumps to State 2 when SmxJMP is ON regardless of the current State number. All outputs at State 2 may be ON or OFF just like at the other states.
- **SmxINT:** This input is the INTERRUPT input and is not implemented at current version. This input is reserved for future use.
- **SmxIn1...SmxIn16:** Each state machine has 16 independent .inputs. The run time status of these inputs is used as a jump (transition) condition from one state to another. The status of each input shall be selected as ON, OFF, Rising Edge, Falling Edge at the State Machine Table. Each input shall be connected to a result of any logical operation at the ladder diagram. A single input may be used as a jump (transition) condition of many states.

State Machine outputs are used in Contact Columns in ladder diagram. Outputs are;

- **SmxQ1...SmxQ16:** Each state machine has 16 independent .outputs. Each output may be ON / OFF at any state, except State 1(always OFF at State 1), independently. ON / OFF is entered at State Machine Table.

Each row at the State Machine table holds the parameters of a single state. The Preset and time base parameter of internal timer for each state is entered at the table. The ON / OFF value of each output is determined for each state at the table.

When State Machine jumps to a new state, the Preset and time base of new state is loaded to internal timer automatically, and timer starts counting down to 0. Internal timer may be used as condition to jump when it reaches to 0.

For each state, 2 separate conditions may be set; C1 (Condition1) and C2 (Condition 2). When one of these conditions is satisfied, State Machine jumps to the next state written in the “Cx Next” column of that condition. C1 is more prior than C2. If C1 and C2 are satisfied at the same instant, C1 is preferred.

There exist two types of conditions to be set as C1 and/or C2;

- **Tmr:** When internal timer reaches 0.
- **SmxIn1...Smln16:** When one of the State Machine inputs is ON or OFF or Rising Edge or Falling Edge (Selection of “Cx Status” cell). Here the inputs (In1...In16) are the inputs (SmxIn1...SmxIn16) of the State Machine, not digital inputs of device (DIn1....DInx).

The state transition does not have to be sequential. State Machine may jump from one state to any state.

It is possible to insert or delete a line at the State Machine Table. Please refer to State Machine Design Screen section for detail.

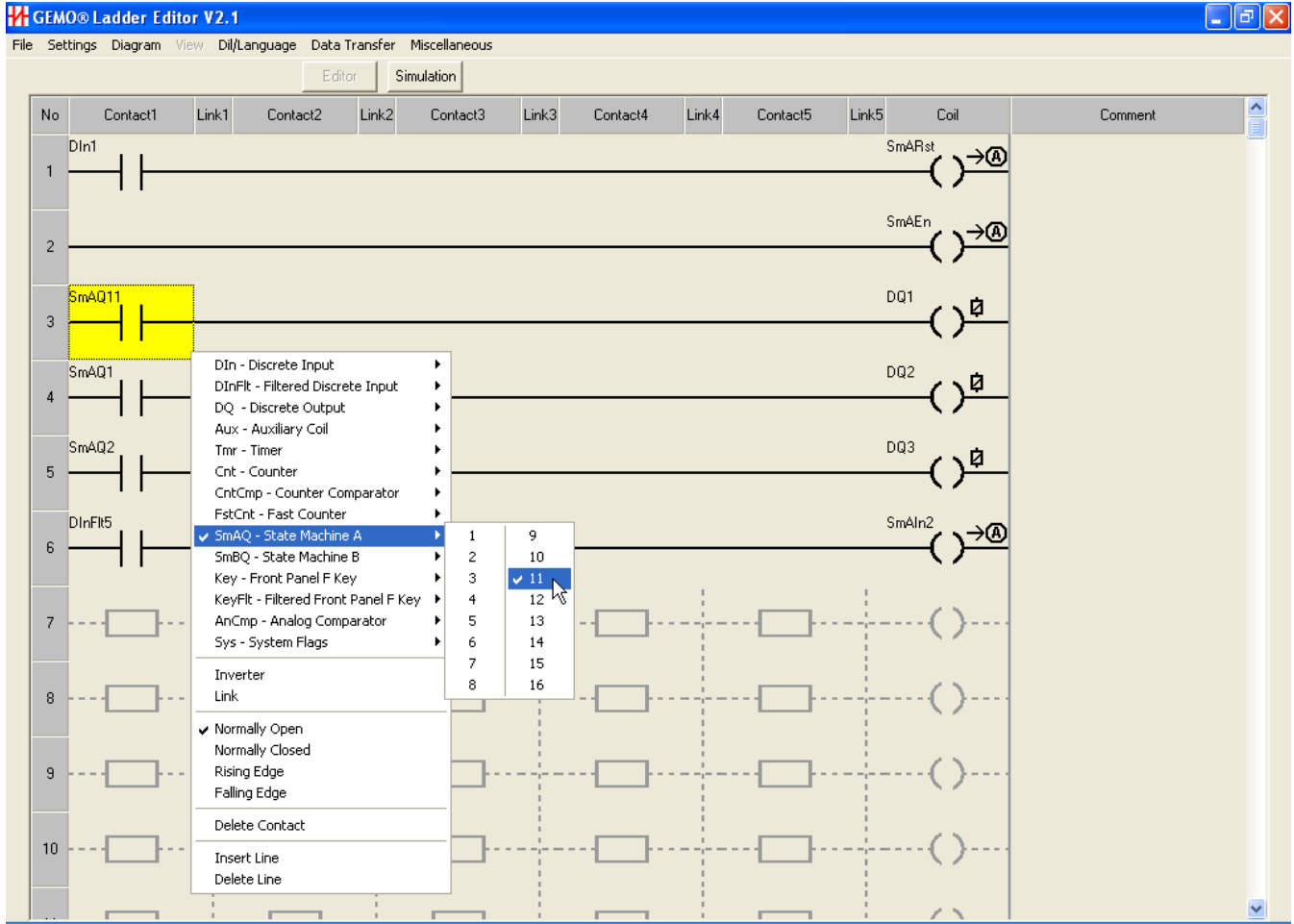
There exist basic warnings regarding state machine usage. These warnings are given before simulation or downloading. Please check and pay attention to these warnings.

It is possible to execute a “procedure call” like event handling by using 2 state machines at the same time. Refer to related application notes.

State Machines may be **retentive** if set in the State Machine Design Screen. Refer to Retention section for more detail. Use retention carefully. Study all conditions that may happen during/after a power failure and/or during/after power is on and take precautions.

State Machine’s first state is State 1 after power on, if it is not retentive. No need to use SmxRST input to reset State Machine only for power on reset purpose, if it is not retentive.

The screenshot displays the GEMO Ladder Editor V2.1 interface. The main workspace shows a ladder logic diagram with 10 rungs. Rung 1 has a normally open contact labeled 'DIn1' connected to a coil labeled 'SmARst'. Rung 2 has a coil labeled 'SmAEn'. Rung 3 has a normally open contact labeled 'SmAQ11' connected to a coil labeled 'DQ1'. Rung 4 has a normally open contact labeled 'SmAQ1' connected to a coil labeled 'DQ2'. Rung 5 has a normally open contact labeled 'SmAQ2' connected to a coil labeled 'DQ3'. Rung 6 has a normally open contact labeled 'DInFlt5' connected to a coil labeled 'SmAln2'. Rung 7 is empty. Rung 8 has a normally open contact labeled 'DInFlt5' connected to a coil labeled 'SmAln2'. Rung 9 is empty. Rung 10 is empty. A context menu is open over the 'SmAln2' coil on rung 6, showing options: DQ - Discrete Output, Aux - Auxiliary Relay, Tmr - Timer, Cnt - Counter, SmAln - State Machine A (selected), SmBIn - State Machine B, Scr - Run Time Screen, TmrTick - Timer Tick, and Delete Coil. A secondary menu is open over the 'SmAln - State Machine A' option, showing a list of states: SmARst (7), SmAJmp (8), SmAlnt (9), SmAEn (10), 1 (11), 2 (12, selected), 3 (13), 4 (14), 5 (15), and 6 (16).



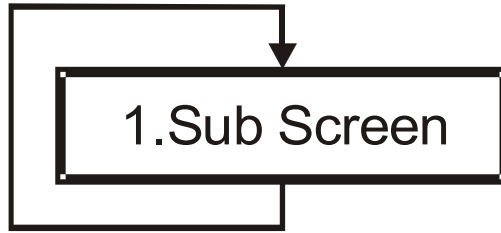
7.15 Run Time Screens

Run time screen design is done via Run Time Screens Screen.

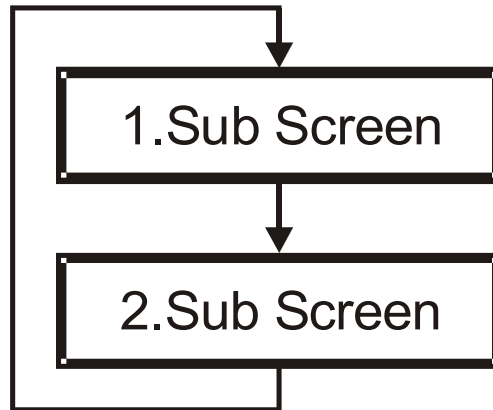
AR2 has 32 Run Time Screens and 1 Welcome Screen that can be designed by user.

Each screen is composed of at most 4 sub screens. Each sub screen has 2 rows and 16 columns containing 32 alphanumeric characters (and symbols) in total.

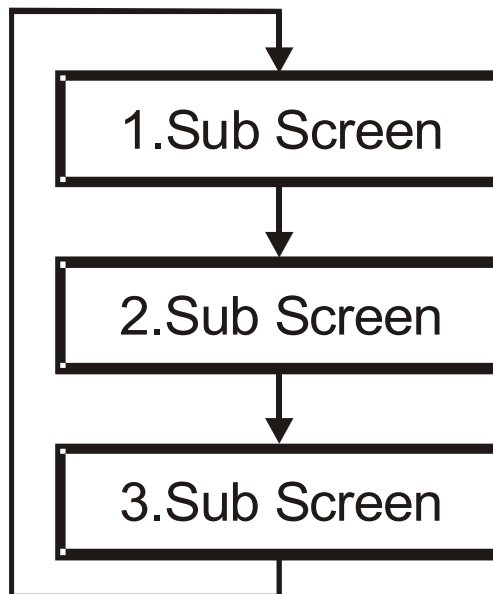
Each screen may have 1 or 2 or 3 or 4 sub screen. When a screen is active during run time, the sub screens of that screen is displayed on LCD one after another. When last sub screen is reached, first sub screen follows it.



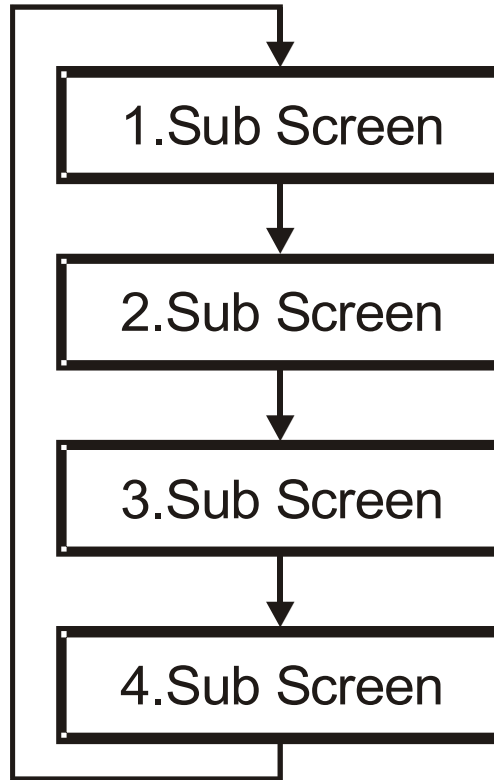
1 sub screen is defined for a Run Time Screen or Welcome Screen



2 sub screens are defined for a Run Time Screen or Welcome Screen



3 sub screens are defined for a Run Time Screen or Welcome Screen



4 sub screens are defined for a Run Time Screen or Welcome Screen

Run Time Screen inputs (Scrx) exist at the Coil Column of ladder diagram. Run time screen with index x is active when Scrx is ON. If more than one run time screens are active during run time, the screen with greatest index is displayed. The run time screen with index number 32 is the post prior one.

Run time screen inputs may be one of the following;

- **Coil Type:** Same as a Digital Output. Refer to Digital Output section.
- **Timed, with Rising Edge:** When the line connected to Scrx has a transition OFF->ON, Scrx becomes ON. The screen with index x becomes active and loops “Number of Loops” times and then Scrx becomes OFF automatically, hence the screen with index x becomes inactive. This type of screen is self times and does not require an external timer. “Number of Loops” is entered as a parameter for each screen, to a box located under the screen design table. Under this box, the duration of the screen active time is also displayed. Scrx input in this mode is retriggerable, that is if there exists another OFF->ON transition on Scrx input, the screen with index x starts looping from the beginning with sub screen 1.
- **SET, Level:** Same as a Digital Output. Refer to Digital Output section.
- **RESET, Level:** Same as a Digital Output. Refer to Digital Output section.
- **SET, Pulse:** Same as a Digital Output. Refer to Digital Output section.

- **RESET, Pulse:** Same as a Digital Output. Refer to Digital Output section.

Each run time screen is designed by editing a table with 4 rows. Each row design a sub screen.

Each sub screen may contain a single parameter. The run time value of selected parameter is displayed on any location of the sub screen. The row and column index is entered separately. Parameter type and number is selected from the pop up lists. The appearance of the designed sub screen is viewed on the LCD simulator located below the table.

The parameters are;

- **Tmr, Timer:** Run time (actual) value of any timer (remaining time).
- **Tmr, tA:** tA preset value of any timer.
- **Tmr, tB:** tB preset value of any timer.
- **Tmr, tA-Timer:** tA preset value – (minus) the run time (actual) value of any timer (passed time).
- **Tmr, tB-Timer:** tB preset value – (minus) the run time (actual) value of any timer (passed time).
- **Cnt, Counter:** Run time (actual) value of any counter.
- **Cnt, Preset:** Preset value of any counter.
- **Cnt, Pst-Counter:** Preset value – (minus) the run time (actual) value of any counter. Displays 0 if result is negative.
- **CntCmp, Preset:** Preset value of any counter comparator.
- **SmA, Timer:** Run time (actual) value of internal timer of State Machine A (remaining time).
- **SmA, t.Set:** Preset value of internal timer of State Machine A.
- **SmA, t.Set-Timer:** Preset value – (minus) the run time (actual) value of internal timer of State Machine A (passed time).
- **SmB, Timer:** Run time (actual) value of internal timer of State Machine B (remaining time).
- **SmB, t.Set:** Preset value of internal timer of State Machine B.
- **SmB, t.Set-Timer:** Preset value – (minus) the run time (actual) value of internal timer of State Machine B (passed time).
- **PTC, Reading:** Temperature in Centigrade that measures by one the PTC sensors.
- **AnIn, Reading:** Transformed value of any analog input measurement.
- **AnCmp, Preset:** Preset value of any analog comparator.

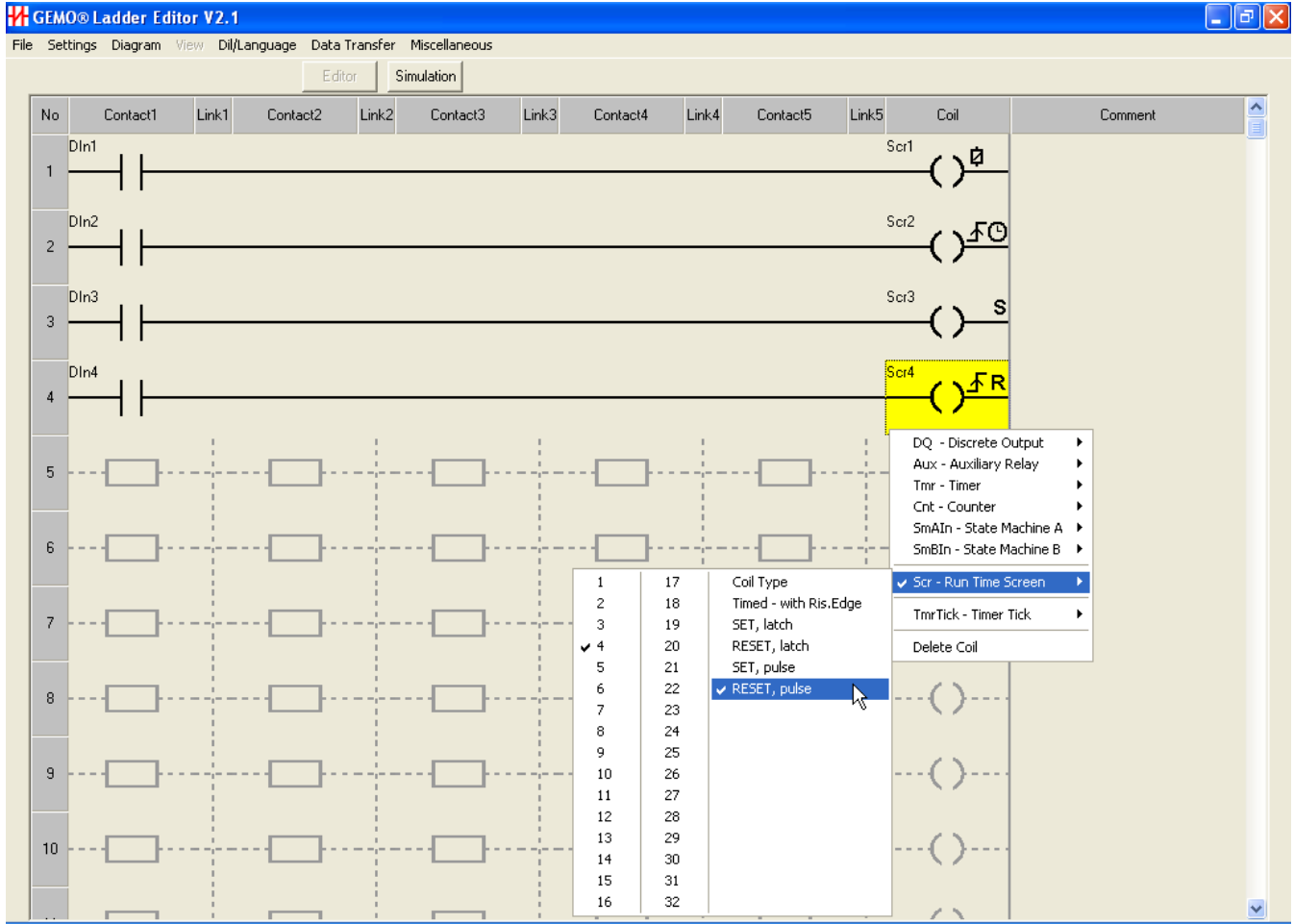
- **Time; HR:MM:SC:** Current time as hour:minute:second in 24 hour format. This function is valid for RTC models.
- **Date; DD:MM:YYYY:** Current date as day:month:year until 2100 (2100 excluded). This function is valid for RTC models.

Each sub screen is displayed for the duration entered at the related row of table. After this duration, next sub screen is displayed. This duration may be set as 1... 250 seconds during design time.

Each sub screen has its own backlight type. One of the following types may be selected for each sub screen separately;

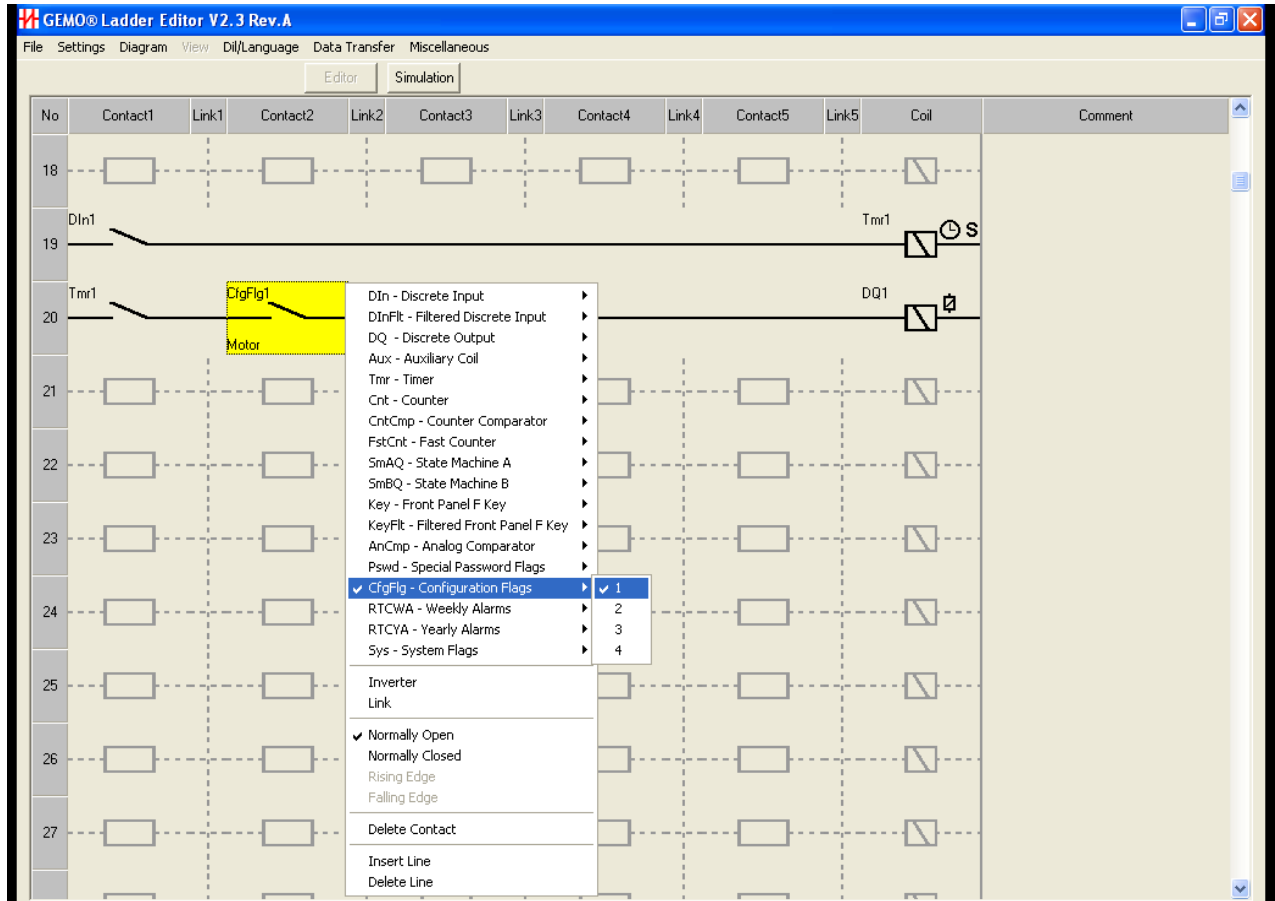
- **ON:** Backlight is ON.
- **ON:** Backlight is OFF.
- **Flashing:** Backlight is flashing. Flashing ON and OFF times are set under the Welcome Screen table during design time. Flashing backlight has its own timer eliminating the use of an external timer. ON/OFF durations may be 0.2...2 seconds.
- **Aux48:** Backlight is OFF when Aux48 is OFF and ON when Aux48 is ON.

Welcome Screen appears only once after power on and does not appear again. No parameter selection can be done for Welcome Screen. Backlight is always ON for Welcome Screen.



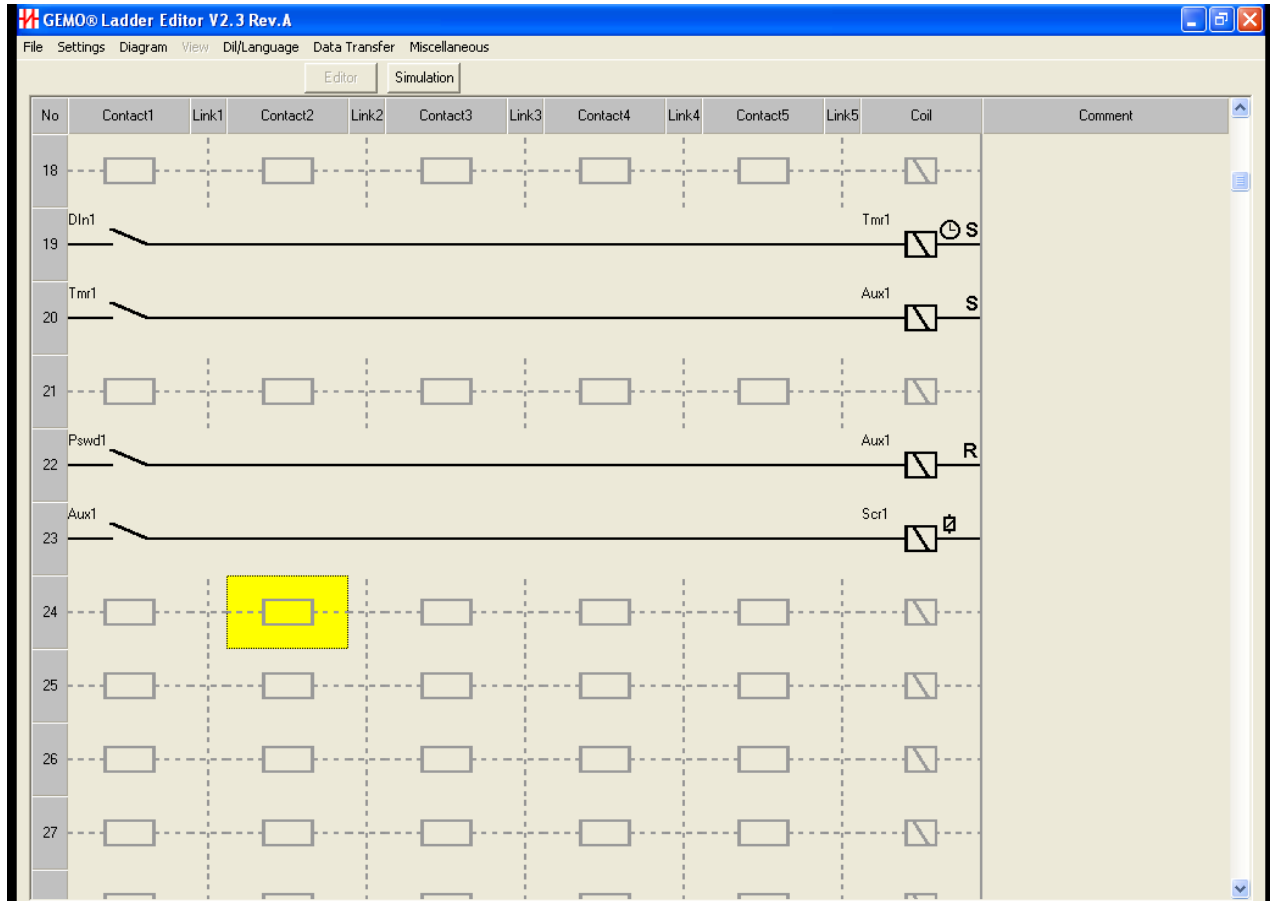
7.16 Configuration Contacts

Value of a configuration contact is either ON or OFF. This value may be altered via the front panel of the device by the user and remains constant. A configuration contact may be used to enable/disable part of a diagram or a function; like disabling operation of a motor permanently.



7.17 Special Password Flags (Contacts)

A special password is not an actual parameter and is not saved anywhere when entered. Its entry is just like the other parameters but its function is different. When the correct password is entered for the selected special password flag via front panel of a device, its contact becomes ON for a single scan time and then OFF again. This feature may be useful to reset an error or a timeout; like one timer sets a retentive auxiliary relay to inform user to replace a filter or a component of a machine, and after replacement, a special password is entered to reset the warning or auxiliary relay. A password entry may be useful to disable some functions of the machine until maintenance is completed and commissioning is done by a qualified personnel.



7.18 Yearly Alarms

One can set a yearly alarm by setting ON and OFF dates. ON and OFF dates are composed of day/month/year parameters. Each parameter may be programmed independently. Partial date entry is possible; such that day/month or year parameter may be disabled. Periodic alarm is possible with partial entry.

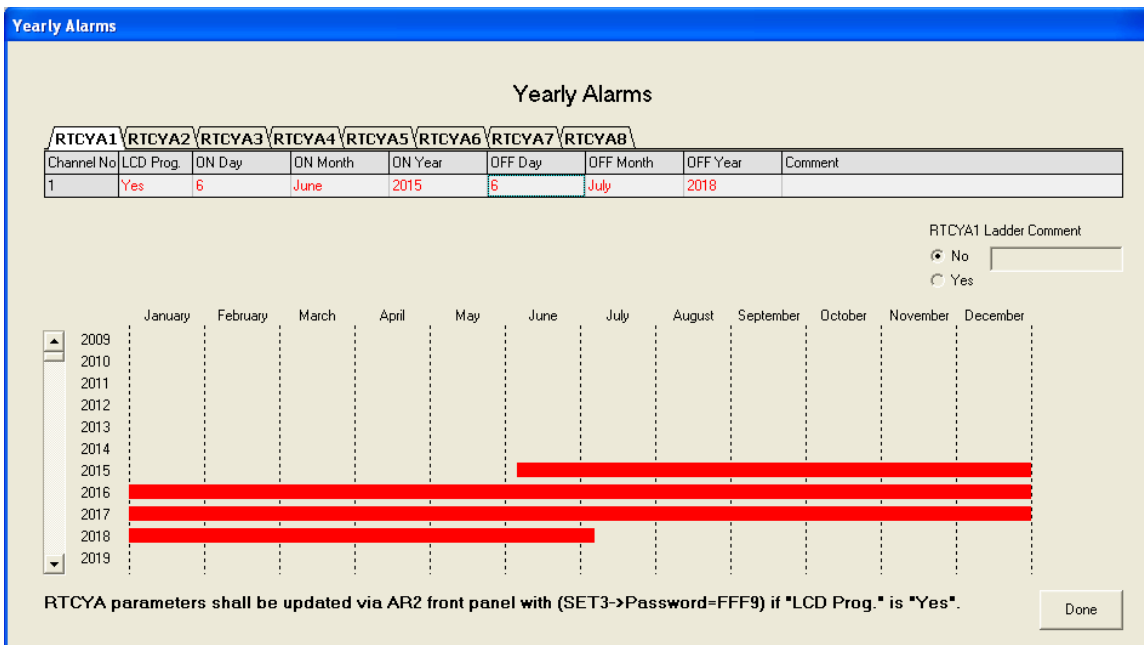
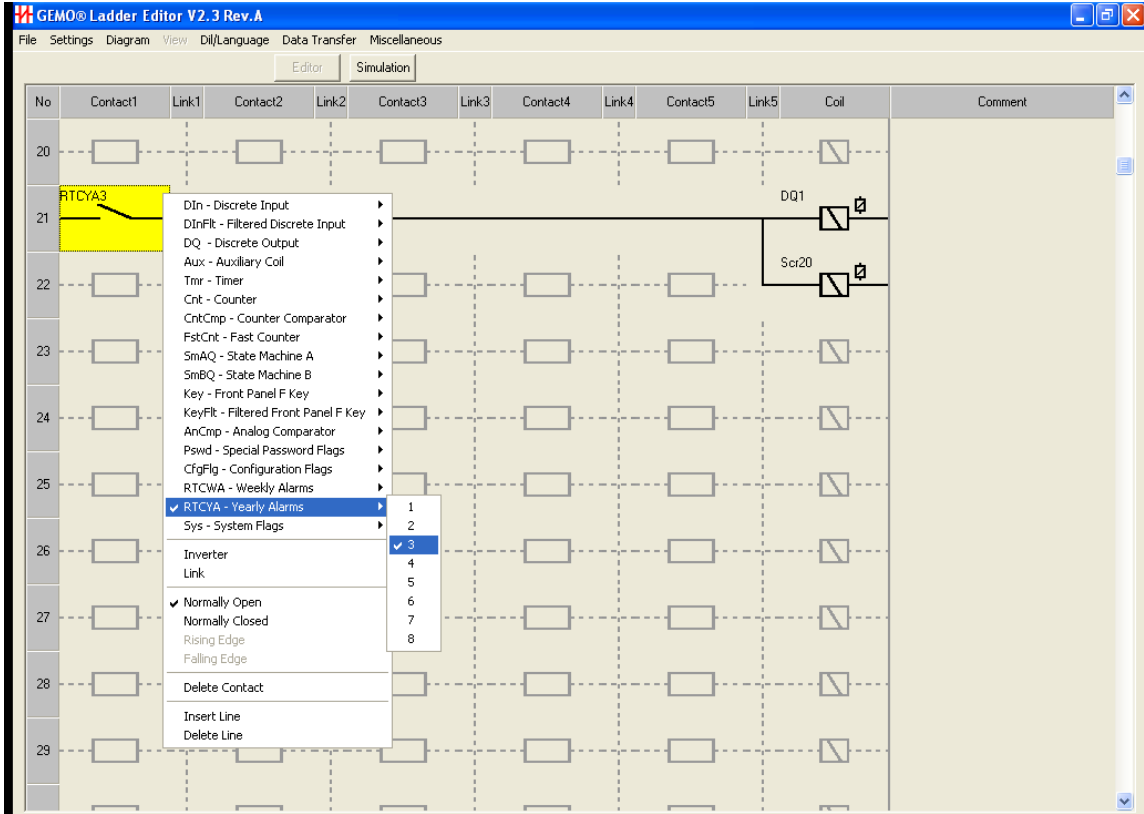
Yearly Alarm table is accessed by Menu->Settings->Yearly Alarms. Parameters of each alarm shall be set independently. Parameters shall be updated via front panel of a device (if LCD_Prog.=Yes is set on the table), with SET3->password=FFF9.

A graphical representation of ON and OFF durations are shown below the yearly alarm table. Selected contact is ON during the red colored section.

A yearly alarm may be ON and OFF in many different cases. One can try and see how a yearly alarm behave by altering the parameters on the table while watching the graphical representation.

There exists a RTC simulator window on the simulation screen. It is also possible to test the behavior of a yearly alarm by changing day/month/year slides on the RTC simulation window.

A yearly alarm contact may be ON just after device is powered on. Power on conditions should be carefully examined and necessary precautions should be taken. If possible, operation should continue with user approval.



7.19 Weekly Alarms

One can set a weekly alarm for one or more days of a week for different and various ON and OFF time with a resolution of a minute. Each ON and OFF time is independently set and enabled.

A weekly alarm is composed of 4 independent channels. The contact state of a weekly alarm is a composition of all 4 channels of that weekly alarm.

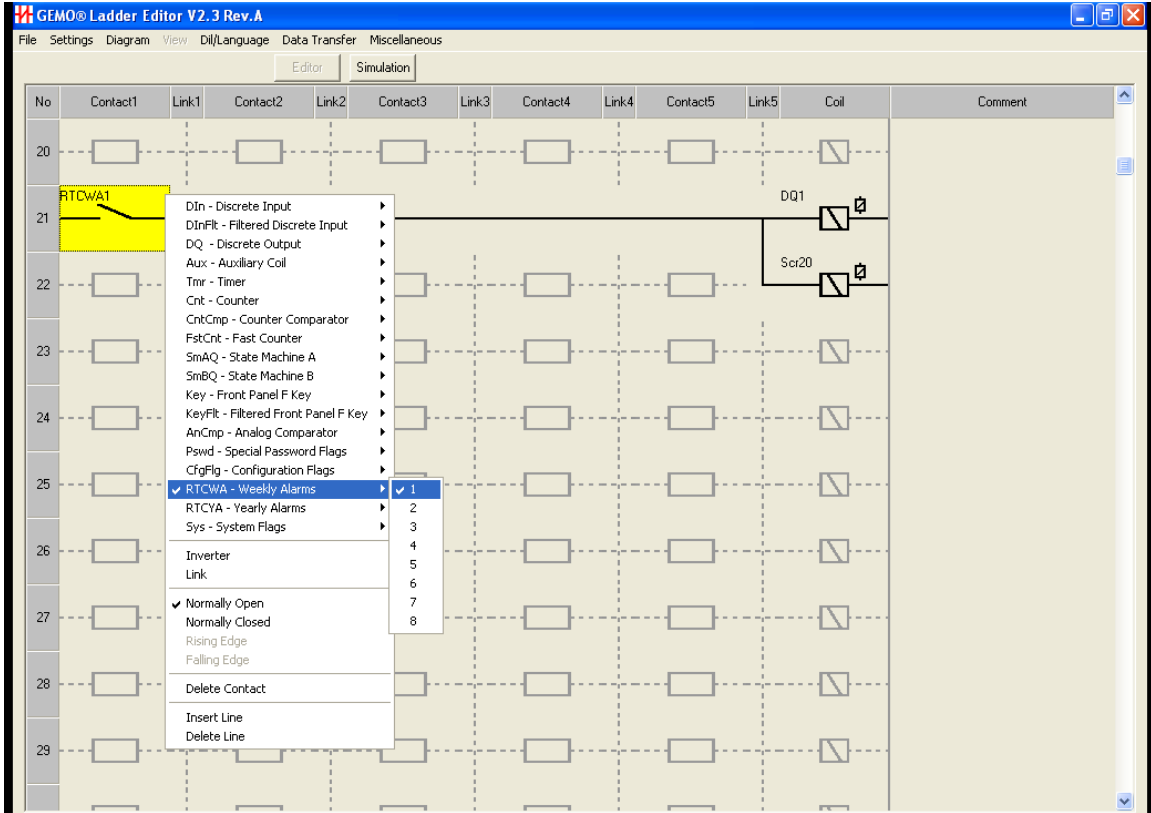
Weekly Alarm table is accessed by Menu->Settings->Weekly Alarms. Parameters shall be updated via front panel of a device (if LCD_Prog.=Yes is set on the table), with SET3->password=FFF8.

A graphical representation of ON and OFF durations are shown below the weekly alarm table. Selected contact is ON during the red colored section.

A weekly alarm may be ON and OFF in many different cases. Many complex ON and OFF patterns may be obtained by setting parameters of channels. One can try and see how a weekly alarm behave by altering the parameters on the table while watching the graphical representation.

There exists a RTC simulator window on the simulation screen. It is also possible to test the behavior of a weekly alarm by changing hour/day/month/year slides on the RTC simulation window.

A weekly alarm contact may be ON just after device is powered on. Power on conditions should be carefully examined and necessary precautions should be taken. If possible, operation should continue with user approval.



Weekly Alarms

Weekly Alarms

Channel No	LCD Prog.	DN	DN Time	OFF	OFF Time	Mon	Tue	Thr	Wed	Fri	Sat	Sun	Comment
1	Yes	Yes	03:25	Yes	12:55	No	Yes	No	Yes	No	No	Yes	
2	Yes	Yes	18:35	Yes	22:50	Yes	Yes	Yes	No	No	Yes	No	
3	Yes	Yes	05:35	No	15:40	No	No	No	No	Yes	No	No	
4	Yes	No	00:00	Yes	15:40	No	No	No	No	No	Yes	No	

RTCWA1 Ladder Comment
 No
 Yes

RTCWA parameters shall be updated via AR2 front panel with (SET3->Password=FFF8) if "LCD Prog." is "Yes".

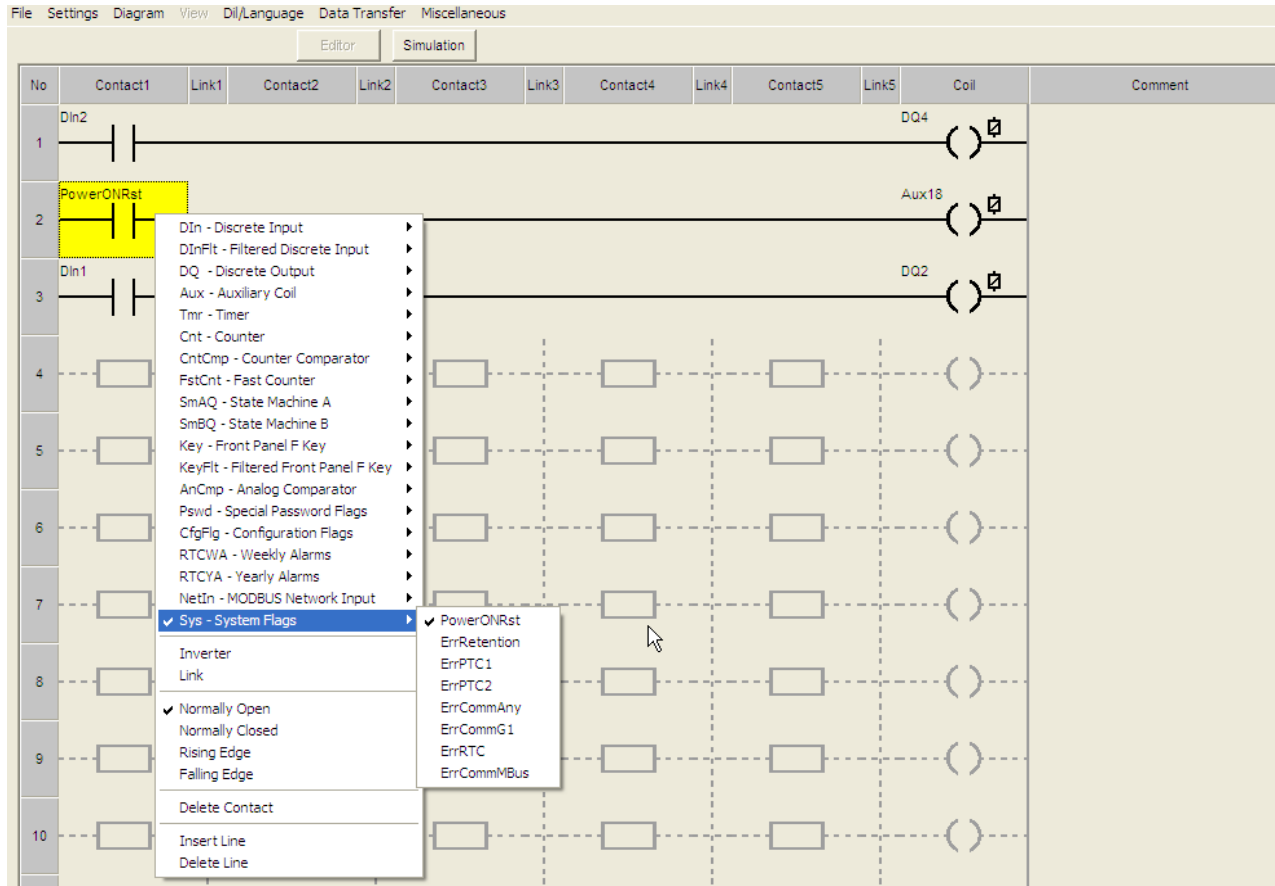
Done

7.20 System Flags (Contacts)

- **PowerONRst:** becomes ON for 0.5 second and then OFF after power is ON. Ladder components already start in their reset status, does not

require any extra resetting connection. This input may be used for starting a special initialization procedure when needed.

- **ErrRetention:** becomes ON when a non volatile memory read error is detected after power is ON, if not always OFF. Editor gives a warning when there exists a retentive component and ErrRetention is not used in ladder diagram. **ErrRetention** is ON during the first power on after a new download is done. This feature shall be used by programmer to test the part of the diagram that uses **ErrRetention** system contact.
- **ErrPTC1:** becomes ON when PTC1 sensor error (sensor or sensor cable failure) is detected or measurement is out of range. Editor gives a warning when PTC1 is used as a parameter of one of the analog comparators and ErrPTC1 is not used in ladder diagram.
- **ErrPTC2:** becomes ON when PTC2 sensor error (sensor or sensor cable failure) is detected or measurement is out of range. Editor gives a warning when PTC2 is used as a parameter of one of the analog comparators and ErrPTC2 is not used in ladder diagram.
- **ErrCommAny:** becomes ON if communication (via RS-485 port) with any of extension modules fails. OFF if communication with all the modules is okay.
- **ErrCommG1:** becomes ON if communication (via RS-485 port) with extension module AR2-G1 fails. OFF if communication with AR2-G1 is okay.
- **ErrRTC:** ErrRTC contact becomes ON if RTC fails, date/time setting is wrong or RTC battery is low. ErrRTC is always ON for the devices that does not have a RTC.
- **ErrCommMBus:** becomes ON if communication (via RS-485 port) with extension module AR2-S-24VDC-MB1 fails. OFF if communication with AR2-S-24VDC-MB1 is okay.



7.21 MODBUS Network Inputs/Contacts

A MODBUS master can write and read a MODBUS Network Input/Contact via messages. So the content of a MODBUS Network Input/Contact may be altered to ON or OFF by the master. User may use MODBUS Network Input/Contact to drive a digital output by using it on the ladder diagram.

MODBUS Network Input/Contacts are all OFF after power on.

File Settings Diagram View Dll/Language Data Transfer Miscellaneous

Editor Simulation

No	Contact1	Link1	Contact2	Link2	Contact3	Link3	Contact4	Link4	Contact5	Link5	Coil	Comment
1	[Symbol]	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
2	NetIn2 [Symbol]	-	-	-	-	-	-	-	-	-	D02 ()	
3	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
4	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
5	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
6	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
7	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
8	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
9	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	
10	[Symbol]	-	-	-	[Symbol]	-	[Symbol]	-	[Symbol]	-	()	

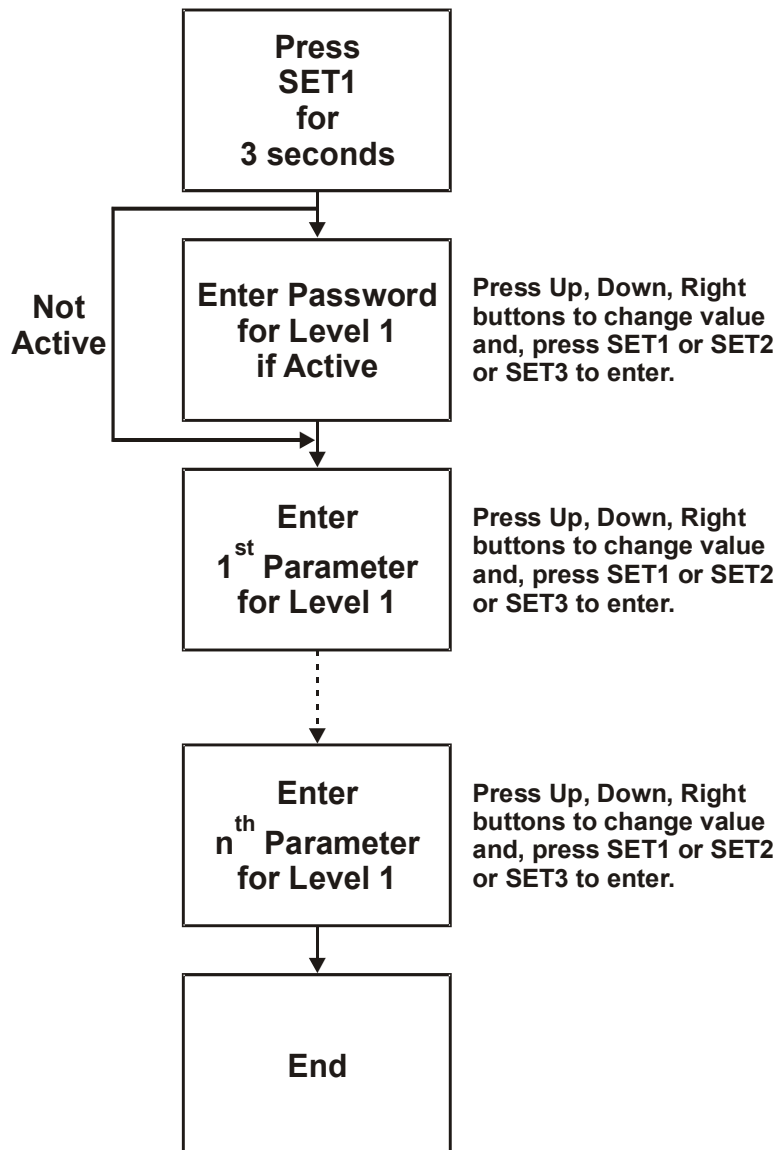
- DIn - Discrete Input ▶
- DInFlt - Filtered Discrete Input ▶
- DQ - Discrete Output ▶
- Aux - Auxiliary Coil ▶
- Tmr - Timer ▶
- Cnt - Counter ▶
- CntCmp - Counter Comparator ▶
- FstCnt - Fast Counter ▶
- SmAQ - State Machine A ▶
- SmBQ - State Machine B ▶
- Key - Front Panel F Key ▶
- KeyFlt - Filtered Front Panel F Key ▶
- AnCmp - Analog Comparator ▶
- Pswd - Special Password Flags ▶
- CfgFlg - Configuration Flags ▶
- RTCWA - Weekly Alarms ▶
- RTCYA - Yearly Alarms ▶
- ✓ NetIn - MODBUS Network Input ▶
 - 1 17 33
 - ✓ 2 18 34
 - 3 19 35
 - 4 20 36
 - 5 21 37
 - 6 22 38
 - 7 23 39
 - 8 24 40
 - 9 25 41
 - 10 26 42
 - 11 27 43
 - 12 28 44
 - 13 29 45
 - 14 30 46
- Sys - System Flags ▶
- Inverter ▶
- Link ▶
- 5 21 37
- 6 22 38
- 7 23 39
- 8 24 40
- 9 25 41
- 10 26 42
- 11 27 43
- 12 28 44
- 13 29 45
- 14 30 46

8 Menu Designer

AR2 Menu Designer is used to design an application specific menu system (user interface) for device user to adjust Preset values of ladder elements via front panel of device during run time.

Menu design is done via Menu Designer Screen.

Menu system is composed of 3 independent and similar menu levels. Each level may contain no or up to 32 different parameters following each other. Parameter types and index of each parameter may be in any order. Any parameter may be used at the same or at other levels at the same menu system, no limitations at all.

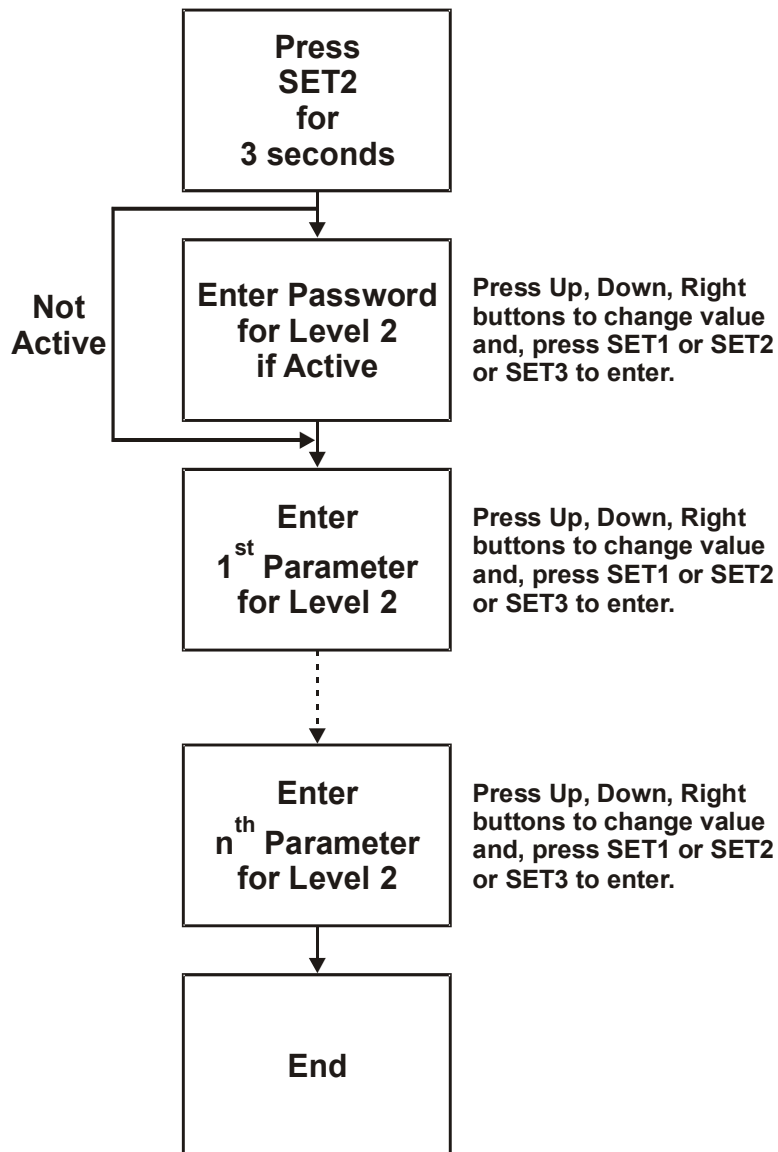


Menu Structure for Level 1

Level 1 and Level 2 may or may not be password protected. But Level 3 is always password protected.

Each password is 4 digits long. 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F characters may be used as a password digit.

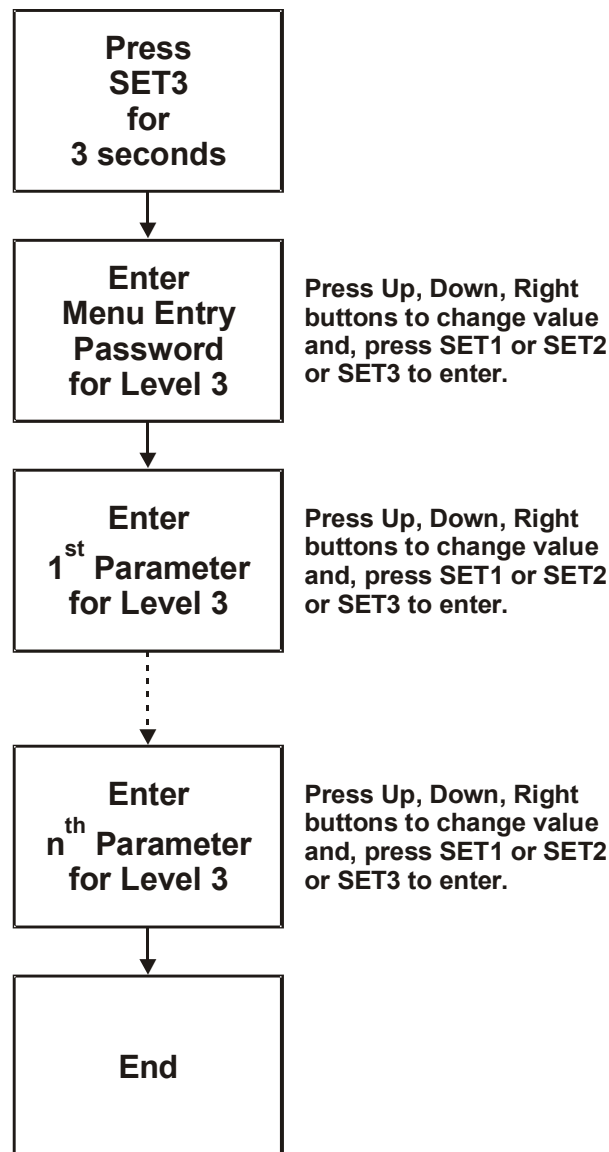
To activate a menu level, press one the SET keys (SET1, SET2, SET3) and keep pressed for approximately 3 seconds during I/O States Screen or one of the Run Time Screens. SET1 activates Level 1, SET2 activates Level2 and SET3 activates Level 3. If selected Level is password protected, the password entry screen appears. If password is entered correctly, the first Parameter entry screen appears afterwards. If password is wrong, menu entry is rejected. If password is not active, then the first Parameter entry screen of the selected menu level appears immediately.



Menu Structure for Level 2

Password and parameter entry is done via Up, Down and Right shift keys. After entry, the new value is store is non volatile memory by pressing SET1 or SET2 or SET3, and next parameter entry screen is displayed. If one of SET1, SET2 and SET3 keys is kept pressed for 3 seconds, menu entry ends (short cut) with last entry already stored.

Level 3 always requires a password. Designer may define menu entry password for Level 3. Level 3 has also some reserved fixed passwords. Designer can not use any of these fixed passwords. Fixed passwords are used to switch to special menus, from Level 3, used for some specific parameter entry.



Menu Structure for Level 3

Fixed passwords for Level 3 are;

- **FFF0:** enter this password to display device type, firmware version and revision information. Firmware version number and editor version number have to be the same.
- **FFF1:** enter this password to update date and time. This password is valid for the devices that have RTC.
- **FFF8:** enter this password to update RTCWA (weekly alarm) settings. This password is valid for the devices that have RTC.
- **FFF9:** enter this password to update RTCYA (yearly alarm) settings. This password is valid for the devices that have RTC.
- **FFF2 ... FFF7, FFFA ... FFFF:** reserved for future use.

Password and Parameter Entry screens are composed of 2 rows, each containing 16 characters (columns). The fixed text that will appear on Row 1 and Row 2 is entered separately at the 'Line 1' and 'Line 2' cells of Password and Parameter Entry Tables.

The 4 digit Password string, the location of the password on LCD (row and column no) are entered on Password table. Also, "Password Active" is set to Yes if selected level is password protected, and no if else.

The parameter type and index, the location of the parameter on LCD (row and column no) are entered on the Parameter Entry Table. Defined parameters are;

- **Tmr, tA:** tA Preset value of any timer.
- **Tmr, tB:** tB Preset value of any timer.
- **Cnt, Preset:** Preset value of any counter.
- **CntCmp, Preset:** Preset value of any counter comparator.
- **SmA, t.SET:** The preset value of any state for the internal timer of State Machine A
- **SmB, t.SET:** The preset value of any state for the internal timer of State Machine B.
- **AnCmp, Preset:** Preset value of any analog comparator.
- **AnCmp, Hysteresis:** Hysteresis value of any analog comparator.
- **CfgFlg:** Value of the selected Configuration Contact; ON or OFF.
- **PTC Offset:** Offset to the selected measured PTC value.
- **AnIn Offset:** Offset to the selected converted Analog input value.
- **Special Password:** Password entry of the selected Special Password Contact. If password is correct, selected special password contact becomes ON for a single scan time and then OFF.

The LCD simulator located at the upper right of the Menu Designer Screen displays the appearance of designed Password and Parameter entry Screens. Click appropriate row of any table and view.

The order of appearance of parameters is just as ordered at the Parameter Table. The rows colored in RED are excluded and do not appear. "Seq. No" (sequence no) number is mark with "-End" expression. To include these rows to menu order, just double click on the "Seq. No" cell of desired row, and a command list appears. Select "Erase Last Line Mark".

Buy selecting the appropriate command from the list, one can insert a new row, delete an existing row, change index of row, exclude and include a row from the menu order (Refer to Menu Designer Screen section).

9 Drawing a Diagram

9.1 Inserting a New Line

Click a contact with the right button of mouse and select “Insert Line”. A new and blank line is inserted to the diagram; all lines including the contact previously selected are shifted down. The last line is deleted at bottom. If bottom line is not an empty line, user is warned before it is deleted.

9.2 Deleting a Line

Click a contact with the right button of mouse and select “Delete Line”. The line where the selected contact exists is deleted, all lines after deleted line are shifted up and a new black line is added as the last line to the bottom of the diagram.

9.3 Deleting a Contact

Click a contact with the right button of mouse and select “Delete Contact”. Or select a contact with the left button of mouse and press “Delete” key.

9.4 Deleting a Link

Click a link with the right button of mouse and select “Dashed Link”. Or select a link with the left button of mouse and press “Delete” key.

9.5 Deleting a Contact

Click a coil with the right button of mouse and select “Delete Coil”. Or select a coil with the left button of mouse and press “Delete” key.

9.6 Deleting a Comment

Select a comment with the left button of mouse and press “Delete” key.

9.7 Selecting and Deleting an Area of Diagram

Select an area of diagram by moving the mouse pointer while keeping the left button of mouse pressed and press “Delete” key. Undo is not possible so please pay attention before deleting an area.

9.8 Fast Line Drawing between Contacts, Links and Coils

Select a contact, link or coil where you would like to start drawing a connection by clicking the left button of mouse. Move the pointer of mouse (or alternatively use “Up”, “Down”, “Left” or “Right” arrow keys) to establish a connection while keeping the “Shift” key pressed.