CONTROLLER PLC FUNCTION MODULE

(PROGRAMMABLE LOGIC CONTROLLER)

USER MANUAL

SMARTGEN (ZHENGZHOU) TECHNOLOGY CO.,LTD.

CONTENT

Chinese trademark

English trademark

SmartGen ─ make your generator *smart*

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Table 1 - Software Version

Date	Version	Note
2015-02-09	1.0	Original Release
2021-02-19	1.1	1. Modified PLC elements icons; 2. Added parameter, cycle timer and communication to PLC elements.

Table 2 - Clarification of Notation

Sign	Instruction
▲NOTE	Highlights an essential element of a procedure to ensure correctness.

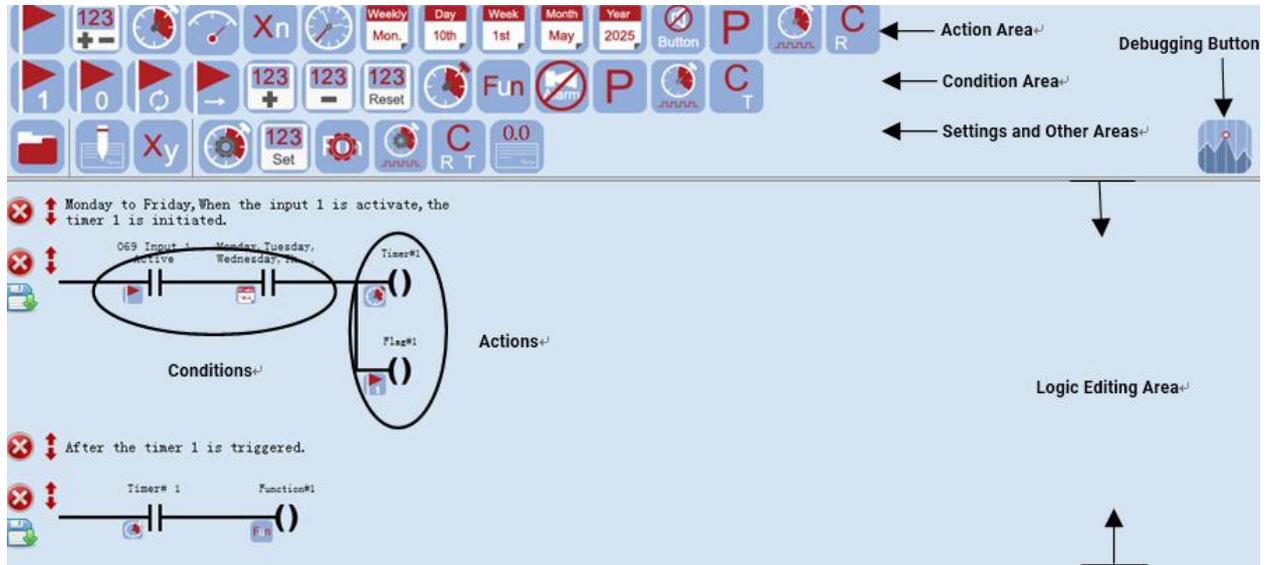# 1 INTRODUCTION OF PLC EDITING INTERFACE AND ELEMENTS

1. 1 PLC EDITING INTERFACE

Fig.1 − PLC Editing Interface

1. 2 PLC INTRODUCTION
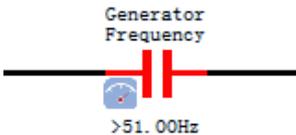
1. 2. 1 ELEMENTS OF CONDITION AREA

Drag the corresponding condition icons to the logical area for editing.

Table 3 Elements of Condition Area

Icon	Condition Name	Description	Example
	Flag Test	Test if the flag is effective.	When the controller is in manual mode, the condition is active; otherwise, the condition is inactive.
	Counter Test	Test if the counter reaches the setting value.	When the Counter 1 reaches the setting value, the condition is active; otherwise, the condition is inactive.
	Timer	Test if the delay time reaches the setting value.	When the delay time of Timer 1 reaches the setting value, the condition is active; otherwise, the condition is inactive.

Icon	Condition Name	Description	Example
	Instument	Test if the measured value reaches the setting conditions	Generator Frequency >51.00Hz When the generator frequency is greater than 51.0 Hz, the condition is active; otherwise, the condition is inactive.
Xn	variable	Test if the variable meets the setting conditions.	X1 <100 When the X1 is less than 100, the condition is active; otherwise, the condition is inactive.
	Time	Test if the current time meets the setting specified periods of time conditions.	08:00->10:00 When the controller time is between 08:00 and 10:00, the condition is active; otherwise, the condition is inactive.
Weekly Mon.	Day of week	Test if the current day of week meets the specified conditions.	Monday When the controller date is Monday, the condition is active; otherwise, the condition is inactive.
Day 10th	Date	Test if the current date meets the specified date conditions.	1st When the controller date is the first day of each month, the condition is active; otherwise, the condition is inactive.
Week 1st	Week Sequence	Test if the current week sequence meets the setting sequence conditions.	01 When the controller date is the first week of each month, the condition is active; otherwise, the condition is inactive.
Month May	Month	Test if the current month meets the setting month condtions.	03 When the controller date is March, the condition is active; otherwise, the condition is inactive.
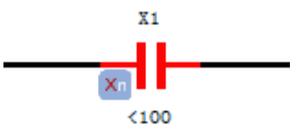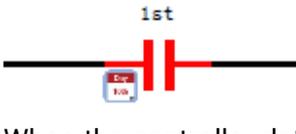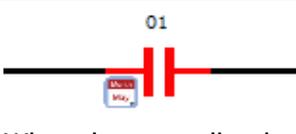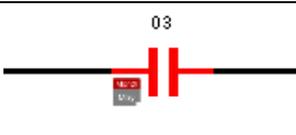
Icon	Condition Name	Description	Example
Year 2025	Year	Test if the current year meets the setting year conditions	2025 When the controller year is 2025, the condition is active; otherwise, the condition is inactive.
Button	Button	Test if the pressed panel button meets the setting button conditions.	UP When the "Up" key of the controller panel is pressed, the condition is actie; otherwise, the condition is inactive.
P	Parameter[①]	Test if the parameter meets the setting conditions.	P1001 <230 When the parameter is less than 230, the condtion is active; otherwise, the condtion is inactive. ⚠Note: The parameter address is the internal protocol, please contact with sales manager if you need.
Cycle Timer[①]	Cycle Timer[①]	Test if the cycle timer and the positive pulse reach the setting value.	Cycle timer 1 When the delay time of Cycle Timer 1is less than the setting value of positive pulse, the condition is active; otherwise, the condition is inactive.
C R	Communication[①]	Test if the communication meets the setting conditions	R1 Data1 <200 When the communication R1 Data1 is less than 200, the condtion is active; otherwise, the condtion is inactive.

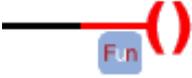①Condition elements only available for HGM9420N_HGM9420LT，HG9510N，HG9520N，HGM9530N.

1.2.2 ELEMENTS OF ACTION AREA

Drag the corresponding icons to the logical area for editing, the logic conditions may have few logic actions.

Table 4 Elements of Action Area

Icon	Action Description	Example
	Action: set Flag to 1. Trigger Mode: triggering when the condition is active.	Flag# 1 Act when condition is active: set Flag 1 to 1. Act when condition is inactive: Flag 1 keeps the original state.
	Action: set flag to 0 Trigger Mode: triggering when the condition is active.	Flag# 1 Act when condition is active: set Flag 1 to 0. Act when condition is inactive: Flag 1 keeps the original state.
	Action: toggle flag (If the original flag is 1, the flag will shift to 0; if the flag is 0, the flag will shift to 1). Trigger Mode: triggering when the condition shifts from inactive to active (Edge-triggered).	Flag# 1 Act when condition shift from inactive to active: Flag 1 toggle.
	Actions: driver flag (set flag to 1 when condition is active; set flag to 0 when condition is inactive. Trigger Mode: Triggering when conditions are active and inactive.	Flag# 1 Act when condition is active: set Flag 1 to 1. Act when condition is inactive: set Flag 1 to 0.
	Action: counter test increases 1. Trigger Mode: triggering when condition shift from inactive to active (Edge-triggered)	Counter# 1 Act when condition shift from inactive to active: The Counter 1 increases 1.
	Action: counter test decreases 1. Trigger Mode: triggering when condition shift from inactive to active (Edge-triggered)	Counter# 1 Act when condition shift from inactive to active: The Counter 1 decreases 1.
	Action: counter reset (the value resets to 0). Trigger Mode: triggering when condition is active.	Counter# 1 Act when condition is active: Counter 1 reset, the value of Counter 1 resets to 0.
	Action: drive delay (the timer continues to count if condition is active; the timer stops the delay	Timer# 1

Icon	Action Description	Example
	when condtion is inactive and rests the timing to 0. Trigger Mode: triggering when conditions are active and inactive.	Act when condition is active: Timer 1 continues to count. Act when condition is inactive: Timer 1 stops the delay and resets the timing to 0.
Fun	Trigger Mode: triggering when condition is active.	Function# 1 Fun ( ) Act when condition is active: trigger Function 1.
Alarm	Action: Shielding alarm (Shielding the set alarms when condition is active). Trigger Mode: triggering when condition is active.	[Shutdown000]-Emergency Stop ( ) Act when condition is active: shielding the emergency stop alarm.
P	Action: set parameters Trigger Mode: triggering when condition is active.	P1001->380 P ( ) Act when condition is active: set 1001 address parameter as 380.
	Action: trigger cycle timer (the cycle timer continues to count when the condition is active while stops the delay when the condition is inactive). Trigger Mode: triggering when condition is active.	Cycle Timer# 1 ( ) Act when condition is active: Cycle Timer 1 circularly counts. Act when condition is inactive: Cycle Timer 1 stops the delay and resets the Cycle Timer 1 as 0.
C T	Action: CAN(2) starts to send the communication. Trigger Mode: triggering when condition is active.	Parameter(T) 1 C ( ) Act when condition is active: CAN sends the data of Communication T1. Act when condition is inactive: stops sending the communication.

1. 2. 3 SETTING AND OTHRER AREAS

Table 5 Setting and Other Areas

Icon	Description	Example
	Open: Clik the icon, open the edited PLC logic file.	
	Label: Drag the icon to the logic area for label to save the notes and remarks about this PLC logic.	It's a PLC routine Label
	Variable: Drag the icon to the logic area for viariable editing.	Edit X1 X1 = Generator Ua + Generator Ub Edit X2 X2 = X1 + Generator Uc Edit X3 X3 = X2 / 3 X3 Flag# 1 ———┤├———————( ) Xn >230 X3 is the average voltage of three-phase generator voltage. When the average voltage is greater than 230, set Flag 1 to 1, otherwise set the Flag 1 to 0.
	Timer Setting Clik the icon to set the timer	Timer limit 1 10.0 s Set the Timer 1 as 10.0s.
	Counter Setting Clik the icon to set he counter	Counter limit 1 5 Set the upper limit of the Counter 1 as 5 times.
	Function Setting: Clik the icon to set the functions.	1 Function 28 RemoteStart OnLoad ▼ Polarity Close to Activate ▼ Set Function 1 as remote start (On load) , close to activate.
	Debugging View: Clik the icon to enter the debugging interface, which includes the status disply of all the flags, counters, timers, viriables, cycle timers and communication.	Flag# 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 The blue number in the debugging interface is the element that involved in the PLC logic (Flag 1 in the figure above is involved in PLC logic.)
	Save Clik the icon and save the PLC logic of this section.	

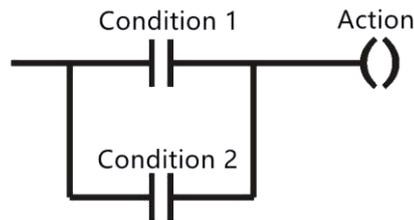| Icon	Description	Example
	Delete Clik the icon and delete the PLC logic of this section.	
	Move: Clik the blue area of the icon and drag it up and down to change the position in the whole PLC logic.	

2   LOGIC INTRODUCTION

2. 1   'OR' LOGIC

Fig.2 – 'Or' Logic

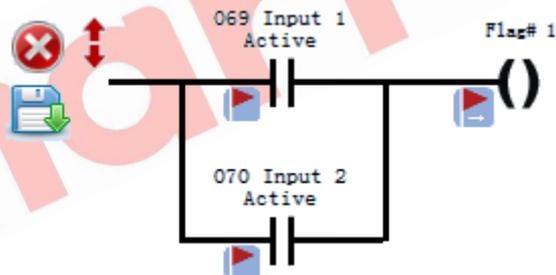Triggering acts when Condition 1 or Condition 2 is active.

For example:

Fig.3 – 'Or' Logic Example

When Input 1 or Input 2 is active, set Flag 1 to 1; otherwise set Flag 1 to 0.

2. 2   'AND' LOGIC

Fig.4 – 'And' Logic

Triggering acts when Condition 1 and Condition 2 are active.
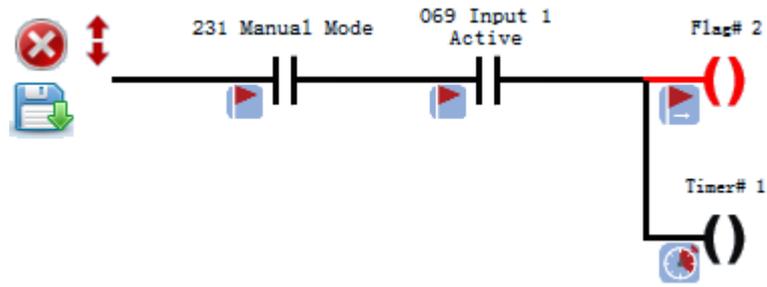
For example:

Fig.5 – 'And' Logic Example

When controller is in Manual mode and the Input 1 is active, set Flag 2 to 1, the Timer 1 starts to count; otherwise set Flag 2 to 0, the Timer 2 resets.
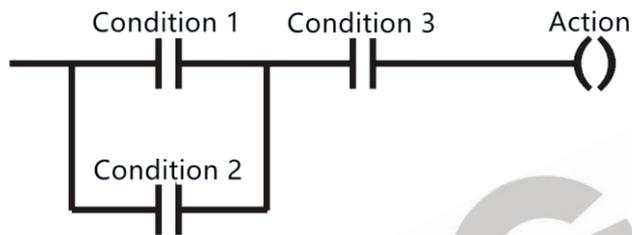
2. 3   COMBINATIONAL LOGIC

Fig.6 – Combinational Logic

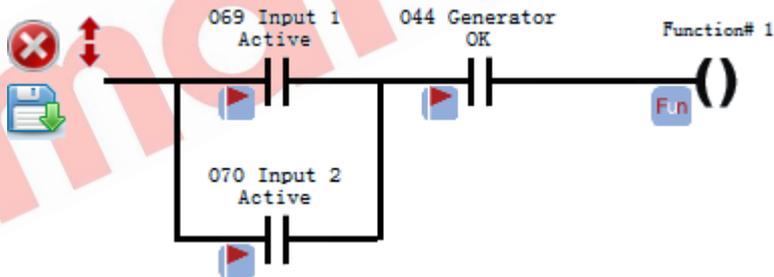Triggering acts when Condition 3 is active, Condition 1 or Condition 2 is active.
For example:

Fig.7 – Combinational Logic Example

In normal generator status, Function 1 triggers when Input 1 or Input 2 is active.

3   APPLICATION EXAMPLES

3. 1   EXAMPLE 1 (OIL PRELUBRICATION)

Requirements: In standby mode, when it outputs 0.5 hour while stops 0.5 hour; outputs when during preheating while it doesn't output during other periods of time.

002 Custom
Period 2   Cycle timer 1

001 Custom
Period 1   Flag# 1

Cycle timer 1

Cycle Timer

	Cycle	Positive Pulse
Timer limit 1	3600.0 s	1800.0 s

Custom Period 1："Preheat"；

Custom Period 2："At Rest".

1 Open ▼ 240 PLC Flag 1 ▼

Oil Prelubrication

Fig. 8 – PLC Example 1

3. 2   EXAMPLE 2 (GENERATOR VOLTAGE ALARM)

Requirements: when the unit is in normal running, if the three-phase voltage difference is greater than 30V, the alarm will be sent after 30s delay.

X1   X1 = Max(Generator Ua, Generator Ub)
X2   X2 = Max(X1, Generator Uc)
X3   X3 = Min(Generator Ua, Generator Ub)
X4   X4 = Min(X3, Generator Uc)
X5   X5 = X2 − X4

X5   045 Generator
          Available   Timer# 1
>30

Timer# 1   Function# 1

1
Function   00 User Configured ▼
Polarity   Close to Activate ▼
LCD Display Unbalanced Volt.

Fig.9 – PLC Example 2

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