Inputs: 1) **Input 1** (toggle switch 1 – represents the first input of the annunciator)

2) **Input 2** (toggle switch 2 – represents the second input of the annunciator)

3) **Ack_Res** (push button – represents the Acknowledge / Reset input, common to both channels)

Outputs: 1) **Lamp 1** (represents the status of input1 of the annunciator)

2) **Lamp 2** (represents the status of input2 of the annunciator)

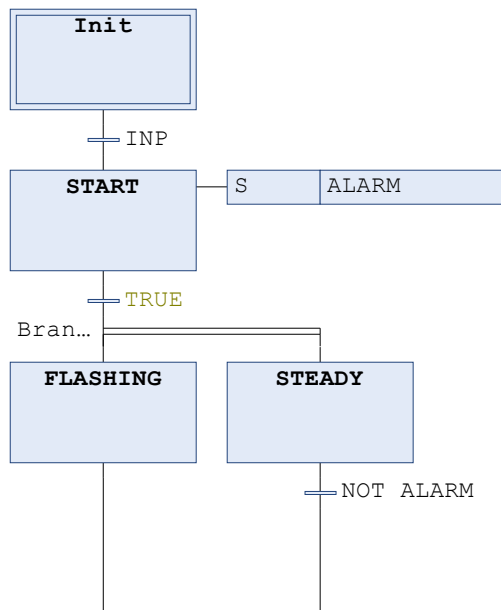3) **Audio** (audio alarm output represented by a lamp)

Description: An alarm annunciator monitors the state of an input (a Boolean variable) which represents whether a measured variable is within the normal operating range or outside it (representing an abnormal operating condition). It generates an audio-visual output to indicate abnormal operating conditions. In this program, we assume that input logic state 0 implies that the variable is within the normal operating range and a value of 1 indicates abnormal operating conditions.
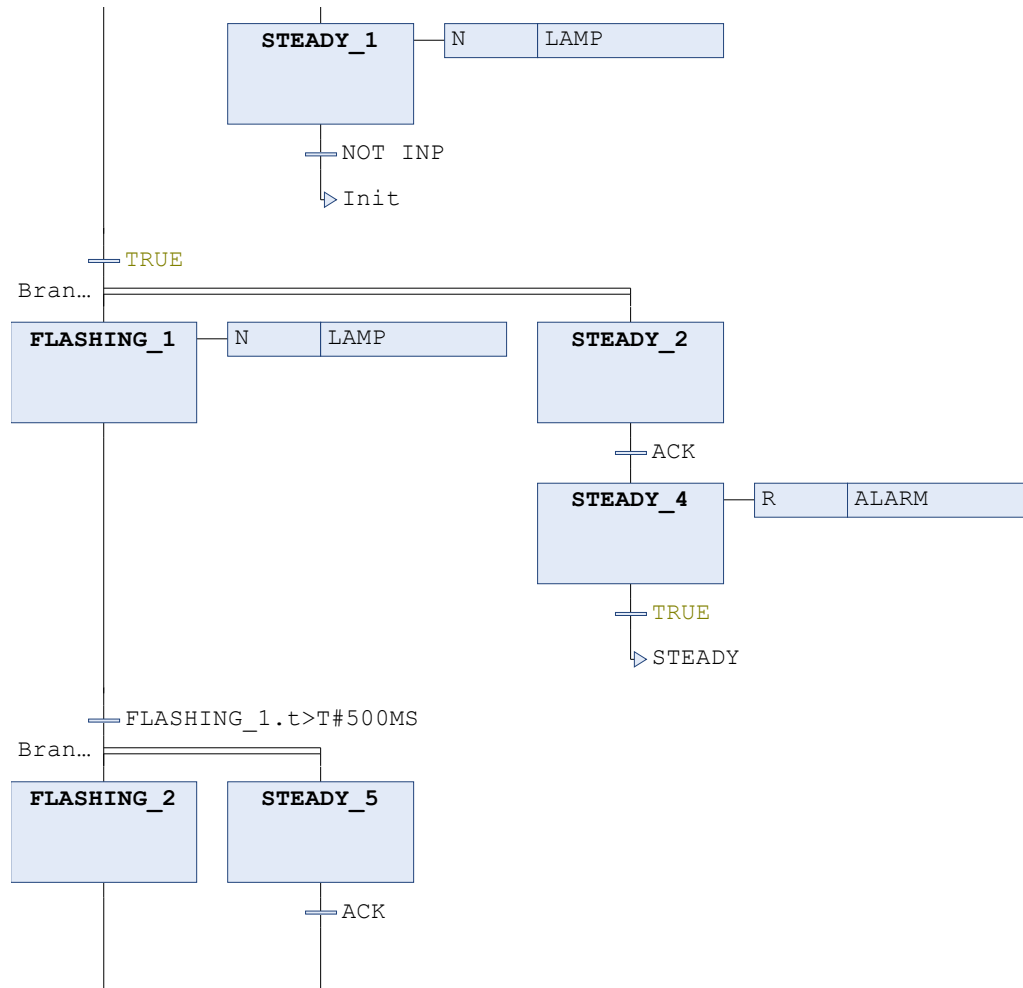
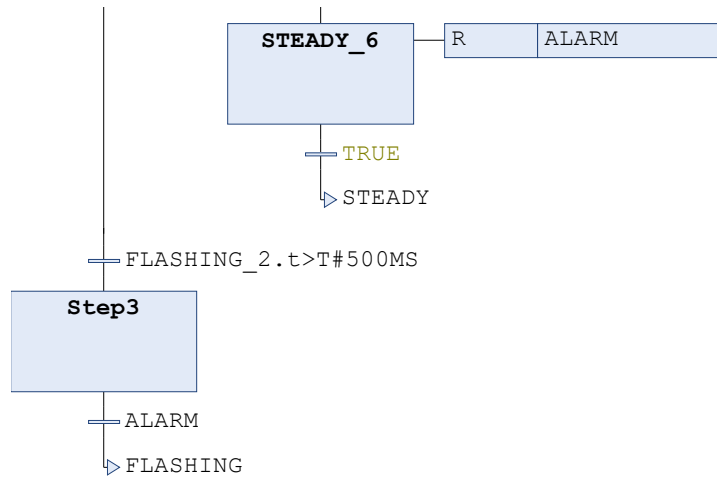**Assignment: Develop a PLC program to implement a 2-channel alarm annunciator.**

1) The Lamp (output) of the alarm annunciator flashes at 1 Hz and the audio output is activated (to draw the attention of the plant operator) when input changes to a logic high, state, signifying an abnormal operating state.

2) When the operator presses the Ack_Reset button (to acknowledge the occurrence of the alarm) the audio alarm is turned off and the output Lamp is now continuously lit instead of flashing. This indicates that the alarm has been acknowledged but the alarm condition persists (that is input is still 1).

3) When the alarm condition returns to normal (input changes to 0), the Lamp turns off.

4) If an alarm condition returns to normal before it is acknowledged by pressing the Ack_Reset push button, then the Lamp continues to flash and audio output remains activated (even though the alarm condition has returned to normal) until the Ack_Reset push button is pressed by the operator, after which the Lamp and the audio alarm both go to the off state.

Hint: Implement a one-channel alarm annunciator using a FB and then use multiple instances of this FB to implement multiple channels.

```
 1     FUNCTION_BLOCK  POU
 2     VAR_INPUT
 3         INP :  BOOL ;
 4     END_VAR
 5     VAR_OUTPUT
 6         LAMP :  BOOL ;
 7         ALARM :  BOOL ;
 8     END_VAR
 9     VAR_INPUT
10         ACK :  BOOL ;
11     END_VAR
12
```

```
                    STEADY_1 ──┤ N │ LAMP        │
                                └────────────────┘

                          ──┤ NOT INP

                          ▷ Init

        ──┤ TRUE
Bran…═══════════════════════════════════════
                                                
FLASHING_1 ──┤ N │ LAMP      │        STEADY_2
             └───────────────┘

                                          ──┤ ACK

                                   STEADY_4 ──┤ R │ ALARM      │
                                              └────────────────┘

                                          ──┤ TRUE

                                          ▷ STEADY

        ──┤ FLASHING_1.t>T#500MS
Bran…═══════════════════════
                                
FLASHING_2        STEADY_5

                      ──┤ ACK
```

```
 1      PROGRAM  PLC_PRG
 2      VAR
 3          CHANNEL_1 :  POU ;
 4          INP_1 :  BOOL ;
 5          ACK :  BOOL ;
 6          LAMP_1 :  BOOL ;
 7          ALARM :  BOOL ;
 8          CHANNEL_2 :  POU ;
 9          INP_2 :  BOOL ;
10          LAMP_2 :  BOOL ;
11          ALARM_1 :  BOOL ;
12          ALARM_2 :  BOOL ;
13      END_VAR
14
```
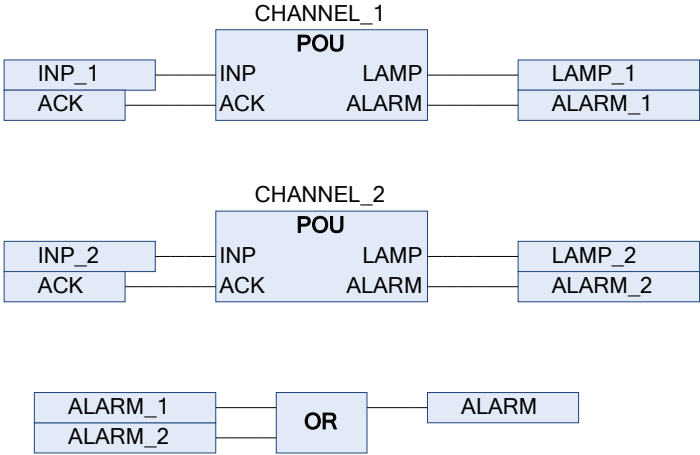
CHANNEL_1

	POU	
INP_1	INP	LAMP	LAMP_1
ACK	ACK	ALARM	ALARM_1

CHANNEL_2

	POU	
INP_2	INP	LAMP	LAMP_2
ACK	ACK	ALARM	ALARM_2

ALARM_1		OR		ALARM
ALARM_2				

General
  Visualization size algorithm version: Respecting scrollbar location
Background
  Use background color: False
  Background color: 16777215
Interface
  VAR_IN_OUT

  END_VAR
Visualization Element List
  Dip Switch Id: 0
  Element name: GenElemInst_2
  Type of element: Dip Switch
  Tab Order: default
  Static optimized: False
  Position
    X: 70
    Y: 40
    Width: 70
    Height: 70
  Variable: PLC_PRG.INP_1
  Image settings
    Transparent: False
    Transparent color: Black
    Isotropic type: Isotropic
    Horizontal alignment: Left

Vertical alignment: Top
Element behavior: Image toggler
Tap FALSE: False
Center
X: 105
Y: 75
Animation duration: 0
Input configuration
OnValueChanged: Configure...
Background
Image: Gray
Push Switch LED Id: 1
Element name: GenElemInst_4
Type of element: Push Switch LED
Tab Order: default
Static optimized: False
Position
X: 235
Y: 40
Width: 190
Height: 190
Variable: PLC_PRG.ACK
Image settings
Transparent: False
Transparent color: Black
Isotropic type: Isotropic
Horizontal alignment: Left
Vertical alignment: Top
Element behavior: Image tapper
Tap FALSE: False
Center
X: 330
Y: 135

Animation duration: 0
Input configuration
  OnValueChanged: Configure...
Background
  Image: Gray
● Lamp Id: 2
Element name: GenElemInst_6
Type of element: Lamp
Tab Order: default
Static optimized: False
Position
  X: 155
  Y: 40
  Width: 70
  Height: 70
Variable: PLC_PRG.LAMP_1
Image settings
  Transparent: False
  Transparent color: Black
  Isotropic type: Isotropic
  Horizontal alignment: Left
  Vertical alignment: Top
Center
  X: 190
  Y: 75
Animation duration: 0
Background
  Image: Yellow
● Lamp Id: 3
Element name: GenElemInst_8
Type of element: Lamp
Tab Order: default
Static optimized: False

Position
  X: 435
  Y: 40
  Width: 190
  Height: 190
Variable: PLC_PRG.ALARM
Image settings
  Transparent: False
  Transparent color: Black
  Isotropic type: Isotropic
  Horizontal alignment: Left
  Vertical alignment: Top
Center
  X: 530
  Y: 135
Animation duration: 0
Background
  Image: Red
T Label Id: 4
Element name: GenElemInst_10
Type of element: Label
Tab Order: default
Static optimized: True
Text ID: 669
Texts
  Text: ALARM
Position
  X: 435
  Y: 240
  Width: 190
  Height: 30
Text properties
  Horizontal alignment: Centered

Vertical alignment: Centered
Text format: Default
Font: Arial;12;Regular;Font-Default-Color, Color [A=255, R=0, G=0, B=0]
Font color
 Transparency: 255
Center
 X: 530
 Y: 255
Animation duration: 0
T Label Id: 7
Element name: GenElemInst_11
Type of element: Label
Tab Order: default
Static optimized: True
Text ID: 191
Texts
 Text: LAMP
Position
 X: 155
 Y: 120
 Width: 70
 Height: 30
Text properties
 Horizontal alignment: Centered
 Vertical alignment: Centered
 Text format: Default
 Font: Arial;12;Regular;Font-Default-Color, Color [A=255, R=0, G=0, B=0]
 Font color
  Transparency: 255
Center
 X: 190
 Y: 135
Animation duration: 0

Label Id: 9
Element name: GenElemInst_12
Type of element: Label
Tab Order: default
Static optimized: True
Text ID: 255
Texts
  Text: ACK
Position
  X: 235
  Y: 240
  Width: 190
  Height: 30
Text properties
  Horizontal alignment: Centered
  Vertical alignment: Centered
  Text format: Default
  Font: Arial;12;Regular;Font-Default-Color, Color [A=255, R=0, G=0, B=0]
  Font color
    Transparency: 255
Center
  X: 330
  Y: 255
Animation duration: 0
Label Id: 11
Element name: GenElemInst_13
Type of element: Label
Tab Order: default
Static optimized: True
Text ID: 347
Texts
  Text: INP
Position

X: 70
Y: 120
Width: 70
Height: 30
Text properties
  Horizontal alignment: Centered
  Vertical alignment: Centered
  Text format: Default
  Font: Arial;12;Regular;Font-Default-Color, Color [A=255, R=0, G=0, B=0]
  Font color
    Transparency: 255
Center
  X: 105
  Y: 135
Animation duration: 0
Dip Switch Id: 13
Element name: GenElemInst_14
Type of element: Dip Switch
Tab Order: default
Static optimized: False
Position
  X: 70
  Y: 160
  Width: 70
  Height: 70
Variable: PLC_PRG.INP_2
Image settings
  Transparent: False
  Transparent color: Black
  Isotropic type: Isotropic
  Horizontal alignment: Left
  Vertical alignment: Top
Element behavior: Image toggler

Tap FALSE: False
Center
  X: 105
  Y: 195
Animation duration: 0
Input configuration
  OnValueChanged: Configure...
Background
  Image: Gray
Lamp Id: 17
Element name: GenElemInst_16
Type of element: Lamp
Tab Order: default
Static optimized: False
Position
  X: 155
  Y: 160
  Width: 70
  Height: 70
Variable: PLC_PRG.LAMP_2
Image settings
  Transparent: False
  Transparent color: Black
  Isotropic type: Isotropic
  Horizontal alignment: Left
  Vertical alignment: Top
Center
  X: 190
  Y: 195
Animation duration: 0
Background
  Image: Yellow
Label Id: 19

Element name: GenElemInst_17
Type of element: Label
Tab Order: default
Static optimized: True
Text ID: 191
Texts
  Text: LAMP
Position
  X: 155
  Y: 240
  Width: 70
  Height: 30
Text properties
  Horizontal alignment: Centered
  Vertical alignment: Centered
  Text format: Default
  Font: Arial;12;Regular;Font-Default-Color, Color [A=255, R=0, G=0, B=0]
  Font color
    Transparency: 255
Center
  X: 190
  Y: 255
Animation duration: 0
Label Id: 23
Element name: GenElemInst_19
Type of element: Label
Tab Order: default
Static optimized: True
Text ID: 347
Texts
  Text: INP
Position
  X: 70

Y: 240
Width: 70
Height: 30
Text properties
Horizontal alignment: Centered
Vertical alignment: Centered
Text format: Default
Font: Arial;12;Regular;Font-Default-Color, Color [A=255, R=0, G=0, B=0]
Font color
Transparency: 255
Center
X: 105
Y: 255
Animation duration: 0