AK-SM 720 — Boolean logic

Application

The function is contained in System manager type AK-SM 720 and can be used for user-defined functions.
The functions can be defined on the basis of the given inputs and outputs, and are limited by the number of the aforementioned inputs and outputs and the grid size.
The user defines the function required. The user must be sufficiently familiar with Boolean logic. Danfoss cannot be held liable for the set-up of the functions.

The logic can be constructed using signals from the following:
- Direct inputs
  • 4 Pressure inputs (AI)
  • 4 Temperature inputs (AI)
  • 2 Voltage inputs (AI)
  • 32 Digital inputs (DI)
- Selected application functions
  • e.g. day/night control, defrosting, light control, etc.
- Internal variables
• 8 Constants
• 16 Temporary variables

The logic can activate the following signals:
- Direct outputs
  • 2 Analogue outputs (AO)
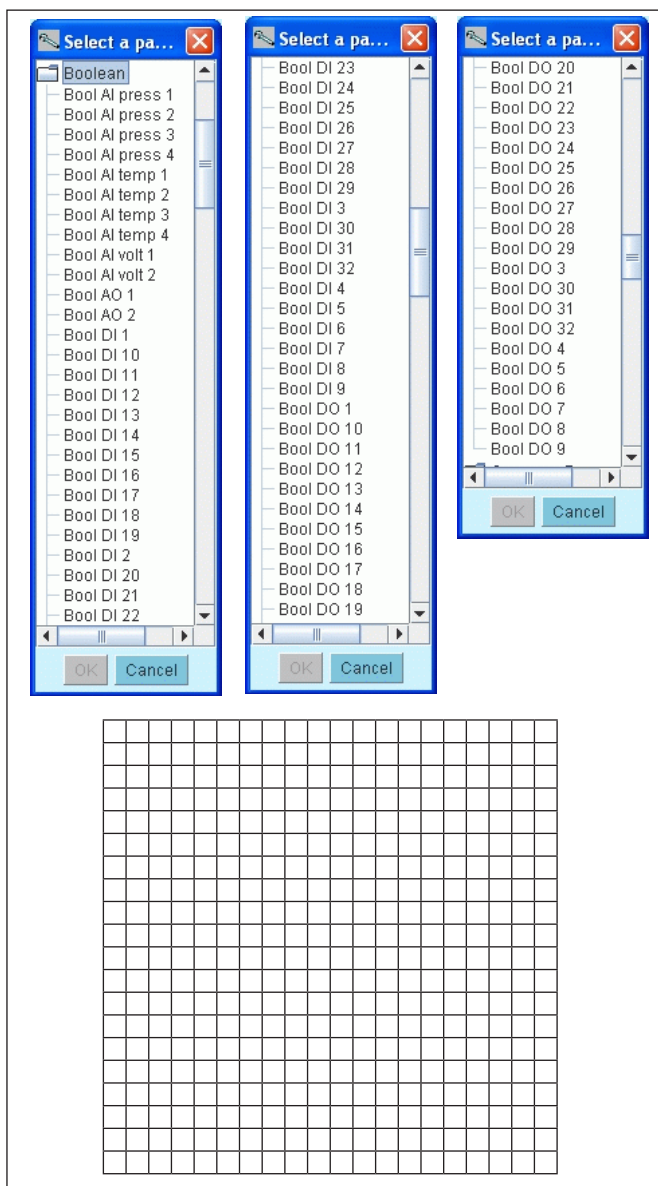 • 32 Relay outputs (DO)
- Selected application settings

Grid size:
- 20 x 20 fields

Note!
The total number of outputs and Inputs which can be connected to a AK-SM 720 is 80 pcs.
See AK-SM 720 manual for further details.

Content

Function units

Depending on the type, a function unit can:
• Read an input value
• Perform a calculation
• Forward a value
• Save a set (constant) value
• Save a temporary value
• Activate an output

Contact points
A function unit may have several contact points, which function as inputs and outputs depending on the type.

Signal path
The individual function units are assembled to form a collective function in a grid. Each function unit is executed one by one. Reading takes place from left to right and then down. (The program runs through a complete line before it continues onto the next line.)

Examples

	a	b	c	d	e	f	g	h	i	j	k	l
1												
2												
3												
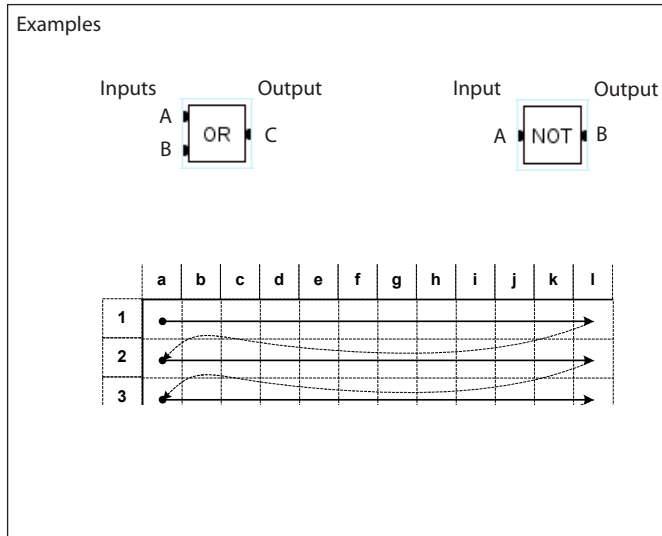
Inputs

I_1 Input signal
E.g. a temperature on an input, a digital signal or the signal from a function.

V_1 Internal variable where a temporary calculation can be used. (Boolean or floating point value)

C_1 Internal constant (Boolean or floating point value)

Output

O_1 Output
E.g. a function, a voltage signal or a relay

V_1 Internal variable where a temporary calculation can be saved. (Boolean or floating point value)

Logical calculations

AND And
$C = A$ AND B

OR OR
$C = A$ OR B

NOT NOT
$B =$ NOT A

DELAY DELAY
Delays a "TRUE" signal for a number of seconds.
The delay period starts every time the input becomes "TRUE".
The input must be "TRUE" throughout the entire delay period in order for the output to become "TRUE".

Mathematical calculations

$+$ Addition
$C = A + B$

$-$ Subtraction
$C = A - B$

$/$ Division
$C = A / B$

$\times$ Multiplication
$C = A \times B$

$>$ Greater than
If $A > B$ then $C =$ TRUE, else $C =$ FALSE

$\geq$ Greater than or equal to
If $A >= B$ then $C =$ TRUE, else $C =$ FALSE

MIN Min.
The smaller value of two input values is reproduced on the output
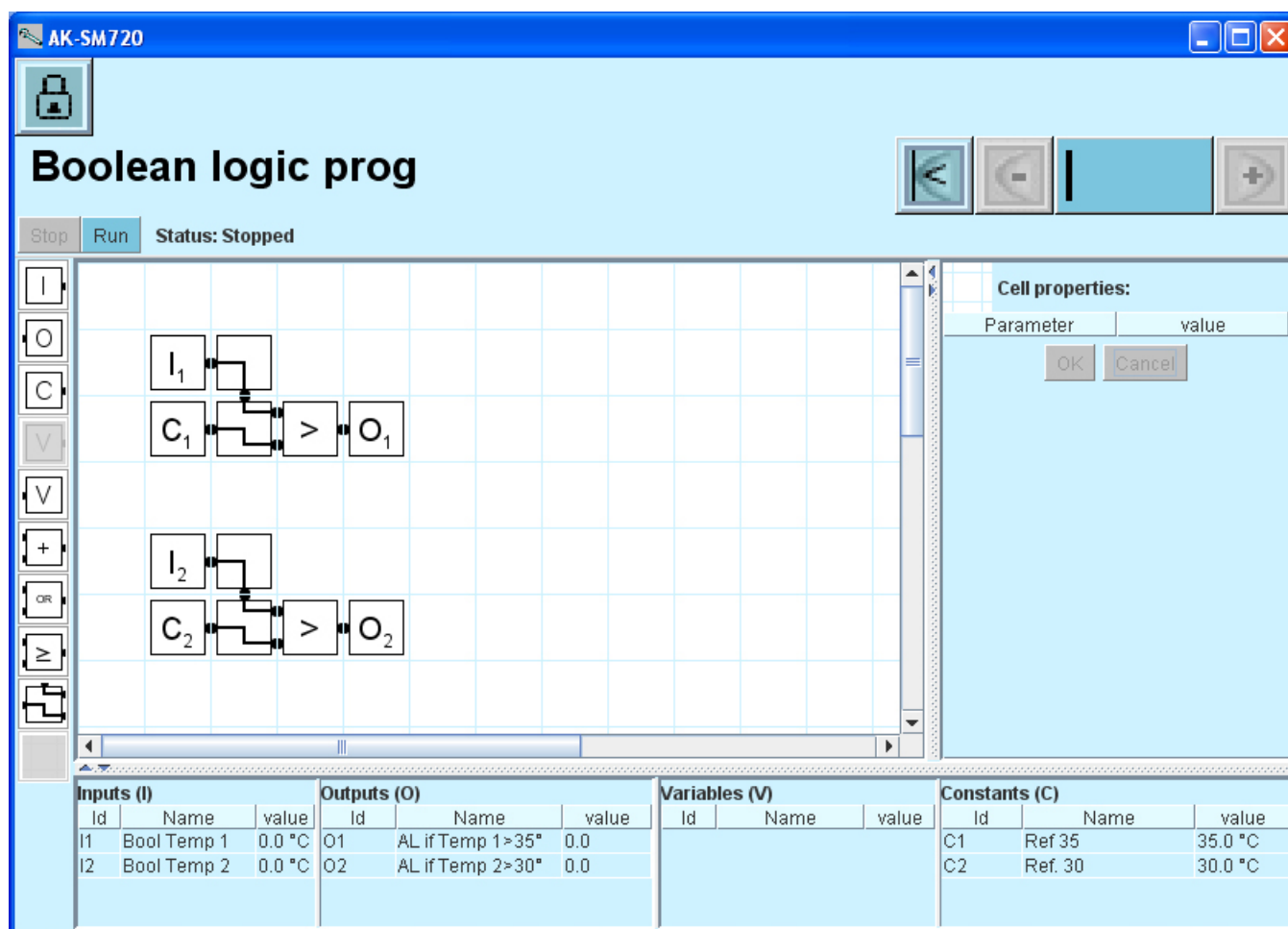If $A > B$ then $C = B$, else $C = A$

MAX Max.
The larger value of two input values is reproduced on the output
If $A > B$ then $C = A$, else $C = B$

AVG Avg.
The average of two input values is reproduced on the output.
$C = (A + B) / 2$

Configuration

Procedure:

1. Highlight a field

2. Insert one of the elements that are shown in the left-hand column (if you select the wrong element, or later want to move the elements around, you can overwrite an element by inserting the "empty" element in place).

3. The settings for the element must then be made. These settings are performed in the right-hand half of the screen. The next page shows the various settings for the elements.

   Constants can be changed during operation. Everything else can only be changed when the logic is stopped.

4. Finally, the functions must be started when the configuration has been completed. Press the "Run" button at the top of the screen.

At the bottom of the screen you can see the status of all the defined elements.

Units for pressure and temperature
e.g. Bar, °C, Psig, °F
All settings and calculations are performed in bar and °C.
They can then be converted to a different unit at a later date.

There are different settings according to which element is defined.

I1: Bool Temp 1
I2: Bool Temp 2
I3
I4
I5

The program will suggest the next number in the series, but if you want a different reference you can change it here.

Cell properties:

Parameter	value
Input reference	I1: Bool Temp 1

I₁ Input reference:

Parameter	value
Name	Bool Temp 1
Parameter	Boolean: Bool AI tem...
Refresh rate	0 sec.
Unit	Temperature

OK Cancel

Temperature
Minutes
Percentage
Seconds
Hours
Windspeed
Rotation
Operating time s

Select a parameter

Boolean
— Bool AI press 1
— Bool AI press 2
— Bool AI press 3
— Bool AI press 4
— Bool AI temp 1
— Bool AI temp 2
— Bool AI temp 3
— Bool AI temp 4
— Bool AI volt 1
— Bool AI volt 2

OK Cancel

• Select Input reference
• Type in name
• Select parameter
• Set "Refresh rate"
• Select Unit
• Press OK
• Remember also to set I/O configuration

AK-SM720
I/O configuration
Analogue Inputs

Sensor	Mod.	Pt	Type
DP 3 RH	0 -	0	0-5 Volt
Bool AI volt 1	0 -	0	0-10V
Bool AI volt 2	0 -	0	0-10V
Bool AI press 1	0 -	0	AKS32R-12
Bool AI press 2	0 -	0	AKS32R-12
Bool AI press 3	0 -	0	AKS32R-12
Bool AI press 4	0 -	0	AKS32R-12
Bool AI temp 1	1 -	1	Pt 1000
Bool AI temp 2	1 -	3	Pt 1000
Bool AI temp 3	0 -	0	Pt 1000
Bool AI temp 4	0 -	0	Pt 1000

During I/O configuration, the position of the connection must be defined.

Cell properties:

Parameter	value
Output reference	O1: AL if Temp 1 > 35°

O₁ Output reference:

Parameter	value
Name	AL if Temp 1 > 35°
Parameter	Bool DO 1

OK Cancel

O1: Bool DO 1
O3: Bool DO 2
O4: Bool DO 4
O5: Bool DO 5
O6: Bool DO 6
O7: Bool DO 7
O8: Bool DO 8

• Select Output reference
• Type in name the name is also entered in the output reference)
• Press OK
• Remember also to set I/O configuration

AK-SM720
I/O configuration
Digital outputs

	Mod.	Pt	Active at
Watchdog	1	17	ON
Modem reset	1	16	OFF
Bool DO 1	1 -	18	ON
Bool DO 2	1 -	20	ON
Bool DO 3	0 -	0	ON
Bool DO 4	0 -	0	ON
Bool DO 5	0 -	0	ON
Bool DO 6	0 -	0	ON
Bool DO 7	0 -	0	ON

During I/O configuration, the position of the output must be defined.

Cell properties:

Parameter	value
Variable referen...	V1: fgsd

V₁ Variable reference:

Parameter	value
Name	fgsd
Unit	None

OK Cancel

• Type in name
• Select unit (if necessary)
• Press OK

Cell properties:

Parameter	value
Constant reference	C1: Ref. 35 °

C₁ Constant reference:

Parameter	value
Name	Ref. 35 °
Unit	Temperature
value	35.0 °C

OK Cancel

• Type in name
• Select unit
• Set value
• Press OK

Examples

Thermostat (heating and cooling)

• If the temperature becomes higher than the set tempera-
  ture for cooling, the relay for cooling will be activated.
• If the temperature becomes lower than the set tempera-
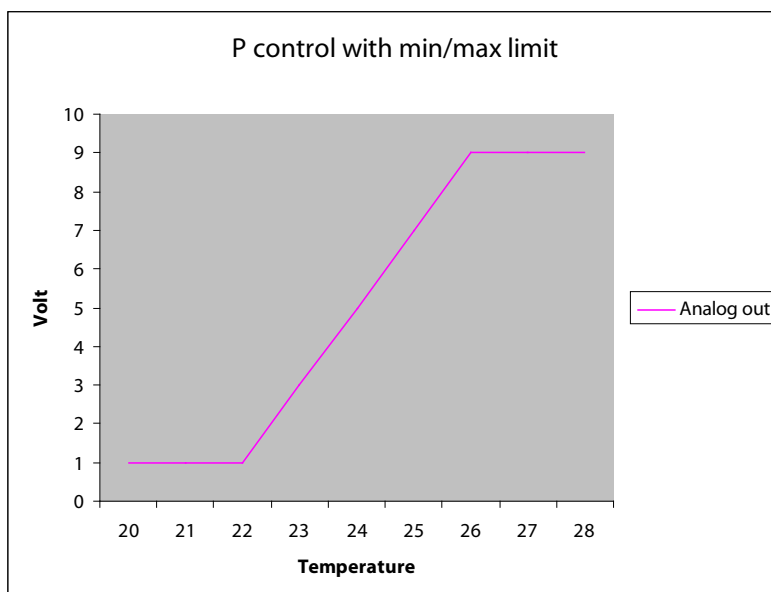 ture for heating, the relay for heating will be activated.
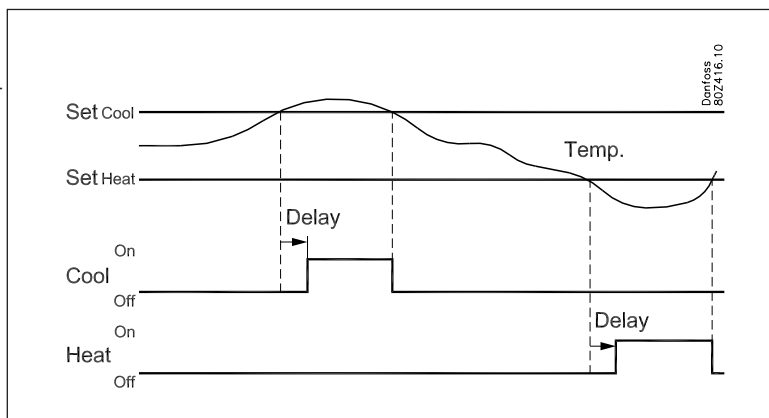
Ref.	Parameter	Unit	Value	I/O
I_4	Bool AI temp 1	Temp		x.x
C_3		Temp	30	
C_4		Temp	2	
O_3	Bool DO 1			x.x
O_4	Bool DO 2			x.x
Delay			120 sec	
Delay			180 sec.	
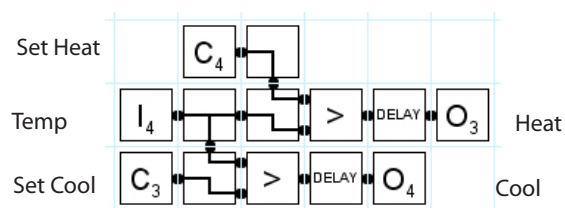
Convert a sensor signal to a voltage signal

I3 temperature (AI1)
C3 reference (22°C)
C4 amplification (2)
C5 minimum lower voltage (1)
C6 maximum upper voltage (9)
O9 analog output 0-10 V (1-9 V)

Ref.	Parameter	Unit	Value	I/O
I_3	Bool AI temp 1	Temp		x.x
C_3		Temp	22	
C_4		None	2	
C_5		None	1	
C_6		None	9	
O_9	Bool AO 1			x.x

P control with min/max limit

DE-BD