

PLUTO Safety-PLC

Description of function blocks Eccentric presses

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1 Safety Note

In the function blocks EPress1 and EpressTHand1 the input "Guard" is only a single channel input without reset function. Presses have often doors and hatches with dual channel switches, sometimes also requiring reset function. For these cases the switches and reset button must be connected to a standard block such as "TC2RTI" or "TC1Sim" whose output then is connected to the input "Guard".

2 Description of function blocks

2.1 EPress1

Eccentric press block with three modes of operation: Single stroke mode, Setting mode and Automatic mode

----- Function -----

In single stroke mode the block controls a single press stroke containing of start with the input "RunSingleStr", take over function and stop in top position. Take over is the position where the input "RunSingleStr" can be released. To get take over the press stroke must be started from top position. If the stroke is started from another position than top or interrupted during the down stroke the take over function is not activated.

In setting mode the movement is also started by the input "RunSingleStr" but the take over function is not active. During downstroke the movement is interrupted by the timer function "InchingTime". The movement is also interrupted at top position.

In automatic mode the press stroke is controlled with the input "RunAutCycle".

The block has monitoring of over run, giving alarm when input "TDC_Cam" gets "0" after stop in top.

The cam switches are monitored. A fault in the cam switches stops the movement and gives alarm "CamFault". To continue, activation of reset is needed.

----- Description of in- and outputs -----

- RunSingleStr: Input for start and protection device in "Single stroke" and "Setting" mode, such as two-hand.
- RunAutCykel: Input for start and stop of press cycle in automatic mode, "AutoMode". When the input switches on in top position a press cycle starts. If the input is on when the stroke reaches top position it continues another stroke, if not it stops.

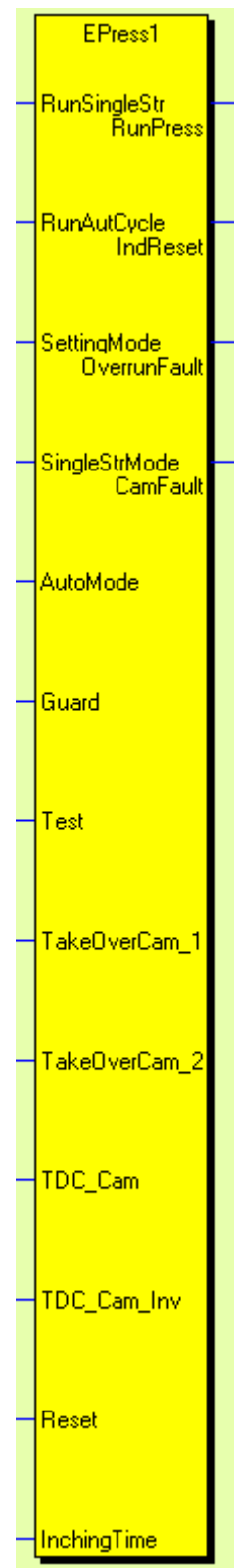
Cam switch inputs:

The block has inputs for 3 different cam inputs but can be used with 2.

- TDC_Cam: Press in top position. Input shall be logic "1" in top position. The cam switch also serves as monitor of brake function (overrun). When the signal switches to "0" after stop in top position overrun alarm is activated.
- TDC_Cam_Inv: Press in top position inverted signal, logic "0" in top position. TDC_Cam and TDC_Cam_Inv can be two contacts in one cam switch.
- TakeOverCam_1: Input for "take over" cam switch
- TakeOverCam_2: A second input for "take over". For presses with only one take over cam, the same switch can be used for both TakeOverCam_1 and TakeOverCam_2.

Other in- and outputs

- SettingMode: Mode of operation "On" = Setting mode
 - SingleStrMode: Mode of operation "On"= Single stroke,
 - AutoMode: Mode of operation "On"= Auto mode
 - Guard: Input for protection device as doors, light curtain etc. The input must always be on to allow movement. If devices shall be active only in some modes of operation this logic can be made outside the function block.
 - Test: A start condition which must be "1" at start of stroke.
 - Reset: Input for reset push button
 - InchingTime: Time constant inching device, interrupt of stroke during downstroke in setting mode.
-
- Output IndReset: Indicator lamp for reset push button.
 - Output OverrunFault: For indication of overrun / brake failure
 - Output CamFault: For indication of cam switch failure.
-
- Main output RunPress: Run press



3 EPressTHand3

Eccentric press block for two-hand with three modes of operation.

----- Function -----

In run mode the block controls a single press stroke containing start with two-hand, takeover function and stop in top position. To get takeover the press stroke must be started in top position. If the press is started from another position than top or interrupted during the down stroke the takeover function is not activated.

In setting mode the takeover function is not active.

In automatic mode the press stroke is started with the two-hand and will continue until the input StopAutCycle is activated by set to "0".

The block has monitoring of over run, giving alarm when input TDC_Cam gets "0" after stop in top.

The cam switches are monitored. A fault in the cam switches stops the movement and gives alarm "CamFault". To continue, activation of reset is needed.

----- Description of in- and outputs -----

Two-hand control type IIC with 0,5s simultaneous operation.

- 4 inputs: TwoH_R_NO - Right normally open contact
- TwoH_R_NC - Right normally closed contact
- TwoH_L_NO - Left normally open contact
- TwoH_L_NC - Left normally closed contact

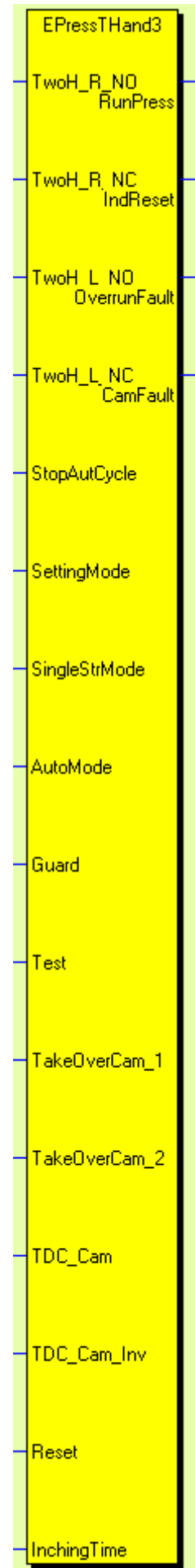
Cam switch inputs

The block has inputs for 3 different cam functions. However the block can be used with less cam switches, minimum 2.

- TDC_Cam: Press in top position. Input shall be logic "1" in top position. The cam switch also serves as monitor of brake function (overrun). When the signal switches to "0" after stop in top position overrun alarm is activated.
- TDC_Cam_Inv: Press in top position inverted signal, logic "0" in top position. TDC_Cam and TDC_Cam_Inv can be two contacts in one cam switch.
- TakeOverCam_1: Input for takeover
- TakeOverCam_2: Input for takeover. For presses with only one takeover cam switch, the same switch can be used for both TakeOverCam_1 and TakeOverCam_2.

Other in- and outputs

- StopAutCycle: Stop of automatic cycle. By "0"-signal the press will stop in top position (Push button shall have NC contact). Start of cycle is done with the two-hand control.
- SettingMode: Mode of operation "On" = Setting mode.
- SingleStrMode: Mode of operation "On"= Run mode.
- AutoMode: Mode of operation "On"= Auto mode.
- Guard: Input for protection devices such as doors, light curtain etc.
- Test: A start condition which must be "1" at start of stroke.
- Reset: Input for reset push button.
- InchingTime: Time constant inching device, interrupt of stroke during down stroke in setting mode
- Output IndReset: Indicator lamp for reset push button.
- Output OverrunFault: For indication of overrun / brake failure
- Output CamFault: For indication of cam switch failure in top position.
- Main output RunPress: Run press movement.



3.1 ValveMonE1

Function for monitoring of eccentric press valve

----- Function -----

Input ValveON control outputs A-coil and B-coil.

The block expects an answer on inputs A_off and B_off after 300 ms, if not the output Fault is set.

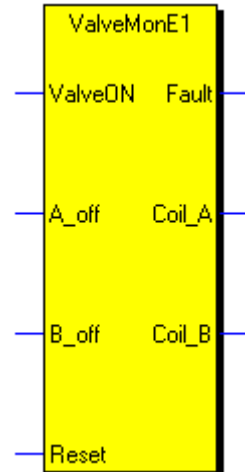
----- Description of in- and outputs -----

Inputs:

- ValveON: Input for demand of valve start
- A_off: Input from sensor A, monitoring A_Coil. "1" = closed valve
- B_off: Input from sensor B, monitoring B_Coil. "1" = closed valve
- Reset: Input for Reset button

Outputs:

- Fault: Fault is detected (Steady high by fault)
- Coil_A: Output for A-coil of the valve
- Coil_B: Output for B-coil of the valve

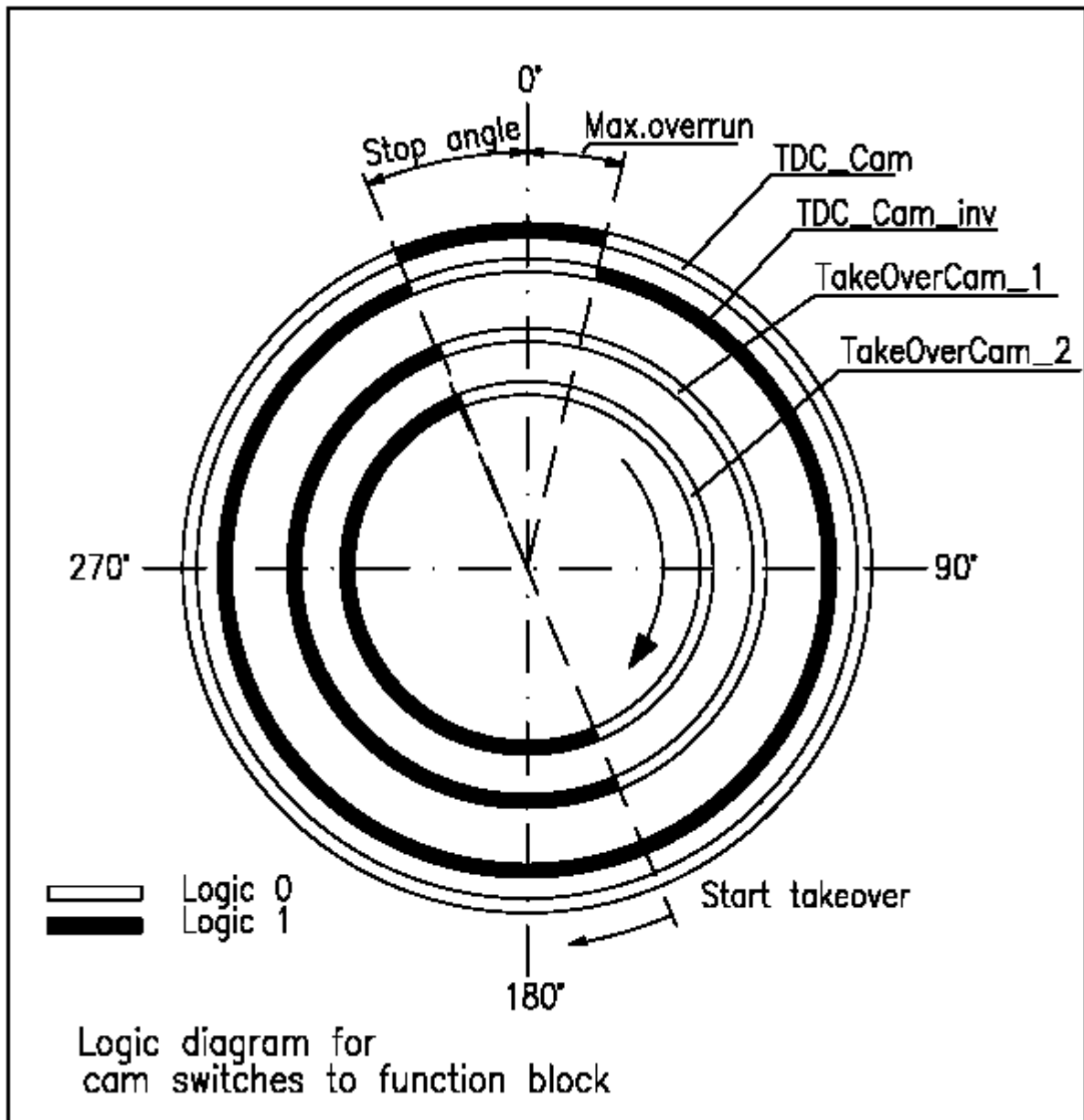


4 Cam arrangement

4.1 Logic function

An essential part of a control system for an eccentric press is the cam system. The diagram below shows the expected logic for the inputs to the blocks (EPress1 and EPressTHand3). Note that the diagram does not show the physical arrangement of cams and the cam switches.

The adjustment of the angles for takeover, stop in top and overrun is individual for each press and is depending on stop performance, safety distances etc. The rules are described in standards as EN 692 and it is very important that the manufacturer of the press is aware of these and the risk around this type of machine.



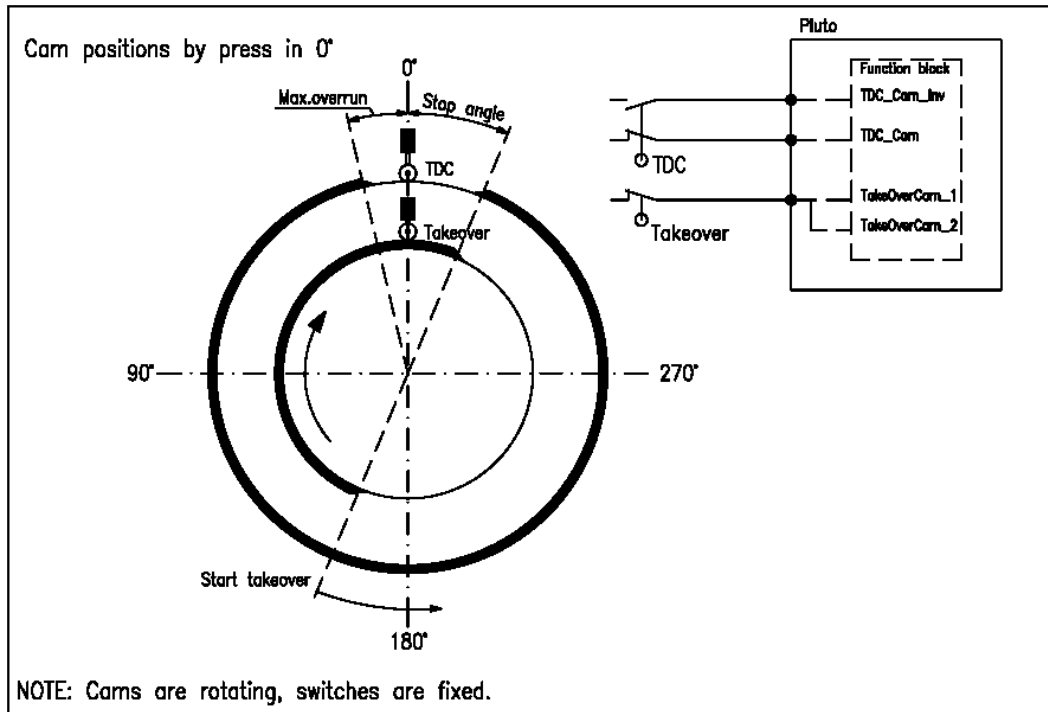
Overlapping of TDC_Cam and TakeOverCam.

When the press reaches top position all three cam signals are switching. The cams shall be set with a small overlap so the signal "TDC_Cam" switches ON before TakeOverCam_1 and TakeOverCam_2 switches low. The overlap shall however be as minimal as possible since the block will give cam fault signal if the press stops at the position where both are active.

4.2 Examples of physical arrangement of mechanical cam systems

The physical arrangement of the cams and cam switches can be made in different ways depending on which kind of switches, cam mechanism, etc. that are used.

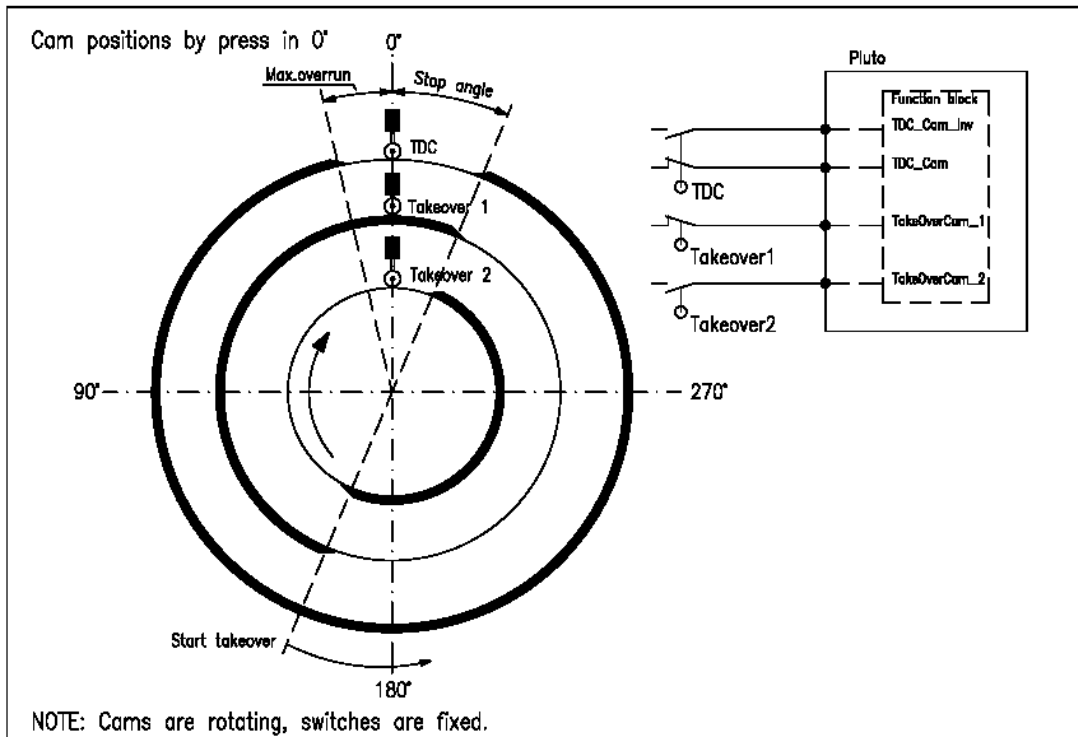
It is important that the designer of the complete press control system does a failure mode effect analysis of the cam system. The absolute most important part is to break the takeover function when the press is reaching the top position.



Example with two cams.

TDC-cam switch is deactivated in top position.

Takeover cam switch is deactivated by take over and activated by stop in top position. The takeover switch should work with positive mechanical action.



Example with three cam switches where the takeover is doubled. The two takeover cams have opposite function in order to achieve diversity.