

AKKON CNC

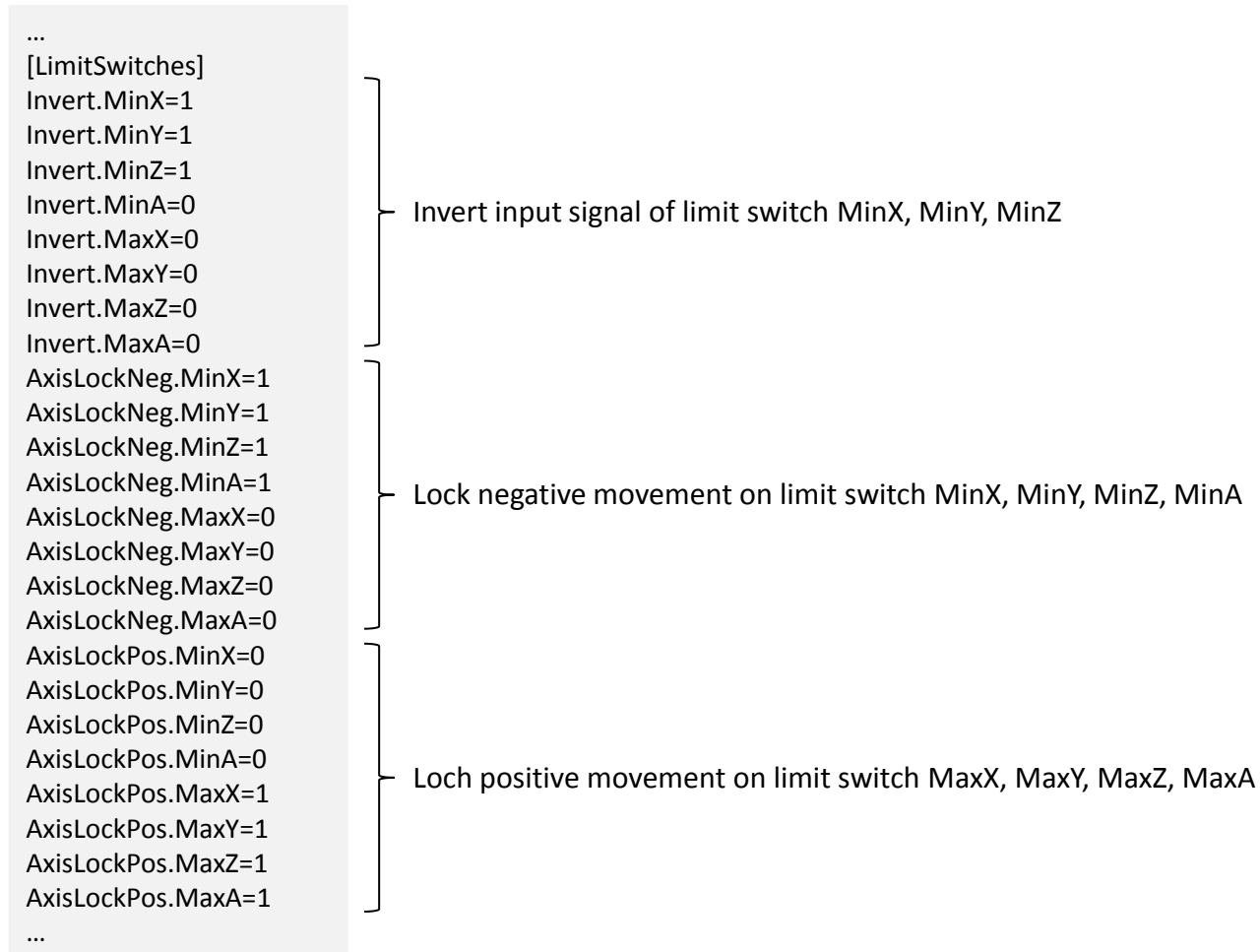
Limit switch configuration

12.04.2012

Limit switch concept and configuration

Akkon supports 8 limit switches that relate to the x-, y-, z- and a-axis. Always two limit switches build a pair and can be used for limiting movement as well as for referencing of the coordinate system. Furthermore, every limit switch can be inverted by configuration, depending on the hardware.

The purpose of each limit switch can be configured one in AKKON.ini as well as on the fly during execution in G-Code.



Capturing of axis will be defined in G-Code R0.txt on reference movement

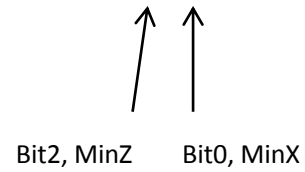
If invert-flag of a limit switch is enabled (1) then input signal will be inverted

Bit assignment of limit switches

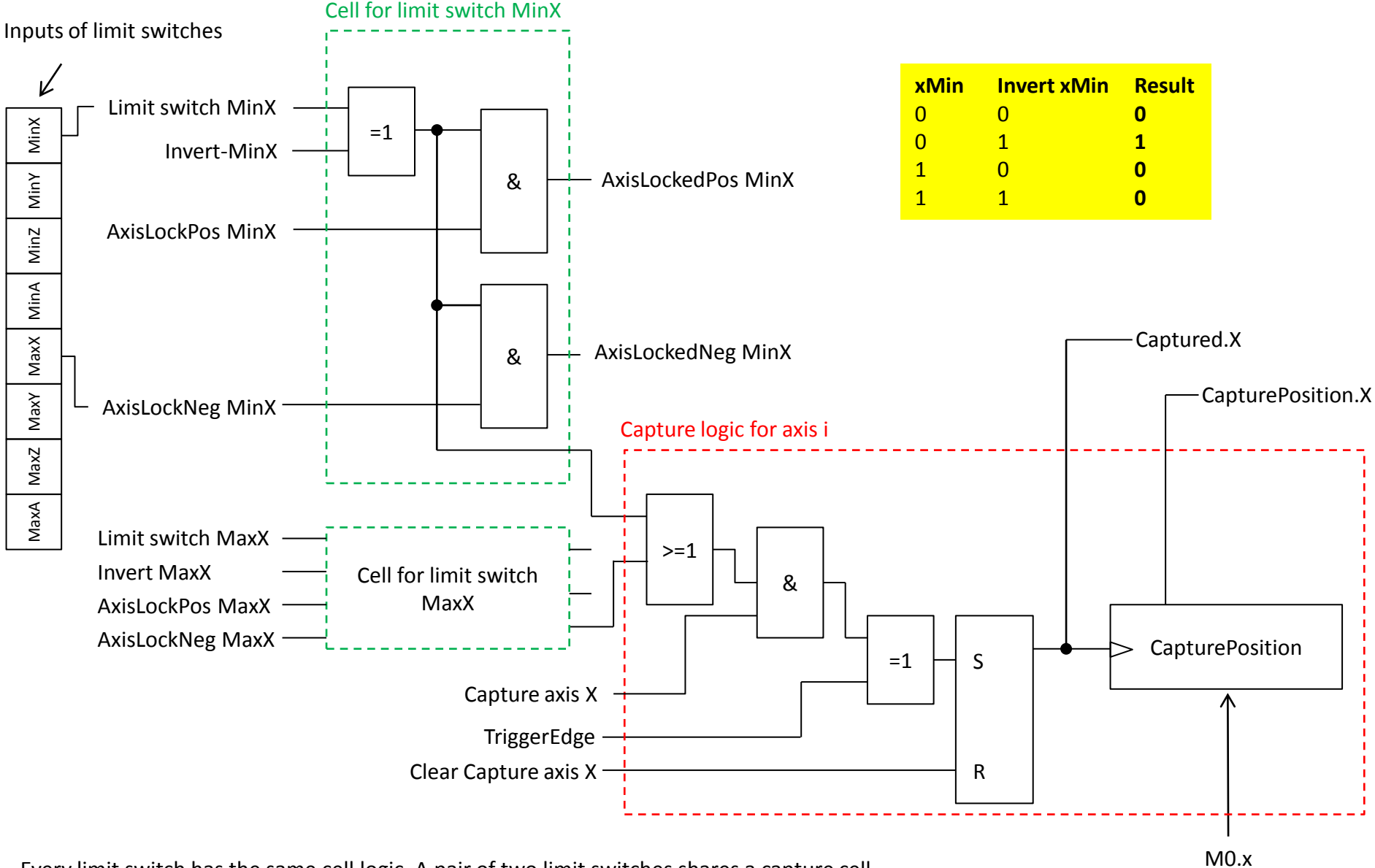
Every input of a limit switch is assigned to specific bit

| | |
|------|------|
| Bit0 | MinX |
| Bit1 | MinY |
| Bit2 | MinZ |
| Bit3 | MinA |
| Bit4 | MaxX |
| Bit5 | MaxY |
| Bit6 | MaxZ |
| Bit7 | MaxA |

Value 00000101



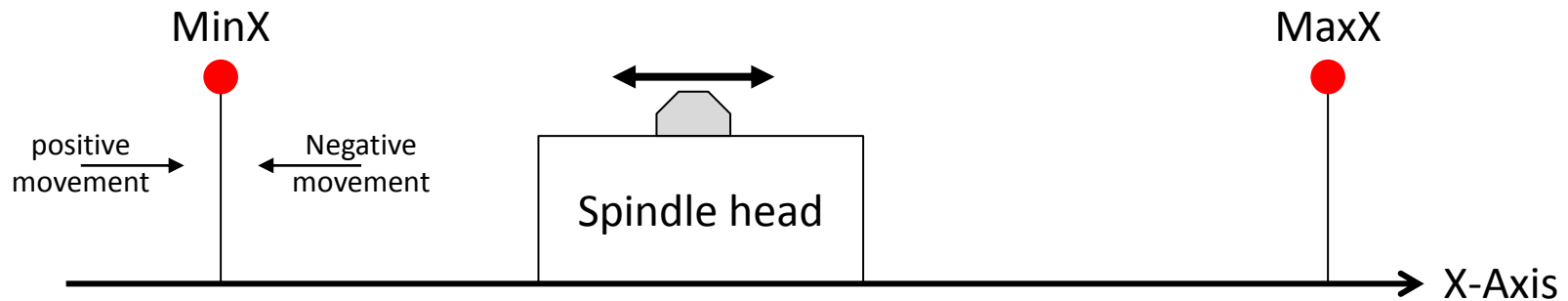
Locking and capture logic for each axis



Every limit switch has the same cell logic. A pair of two limit switches shares a capture cell.

Locking of axis

AxisLockNeg MinX: if enabled, then spindle head will be stopped if limit switch **MinX** is activated and spindle head tries to move in negative direction
AxisLockPos MinX: if enabled, then spindle head will be stopped if limit switch is activated and spindle head tries to move in positive direction



Configuration of limit switches in AKKON.ini

Example:

```
...  
...  
[LimitSwitches]  
Invert.MinX=1  
Invert.MinY=1  
Invert.MinZ=1  
Invert.MinA=0  
Invert.MaxX=0  
Invert.MaxY=0  
Invert.MaxZ=0  
Invert.MaxA=0  
AxisLockNeg.MinX=0  
AxisLockNeg.MinY=0  
AxisLockNeg.MinZ=0  
AxisLockNeg.MinA=0  
AxisLockNeg.MaxX=0  
AxisLockNeg.MaxY=0  
AxisLockNeg.MaxZ=0  
AxisLockNeg.MaxA=0  
AxisLockPos.MinX=1  
AxisLockPos.MinY=1  
AxisLockPos.MinZ=1  
AxisLockPos.MinA=1  
AxisLockPos.MaxX=1  
AxisLockPos.MaxY=1  
AxisLockPos.MaxZ=1  
AxisLockPos.MaxA=1  
...  
...
```

Invert input signal of limit switch MinX, MinY, MinZ

Lock all limit switches in normal operation mode

Capturing of axis will be defined in G-Code R0.txt on reference movement

If invert-flag of a limit switch is enabled (1) then input signal will be inverted

Configuration of limit switches in G-code

Akkon extends G-Code with special M-Commands that can be used for configuration of the purpose of limit switches.

Two commands are supported

N00030 M101 C1 O2 M0 ; lösche Capture-Register aller Endschalter

N00040 M101 C2 O2 M0b00101100 ; Enable capturing of x, y, ZMinreference switch

Description of parameters for M101-G-Code

C..Command: clear register

O..operation code: set all bits of selected register

M..bit mask for operation resp. value that has to be written : bit 0..7; example M0b00101100 : caputer ZMin, MinA, MaxY

Bit 0: MinX

Bit 1: MinY

Bit 2: MinZ

Bit 3: MinA

Bit 4: MaxX

Bit 5: MaxY

Bit 6: MaxZ

Bit 7: MaxA

AKKON CNC

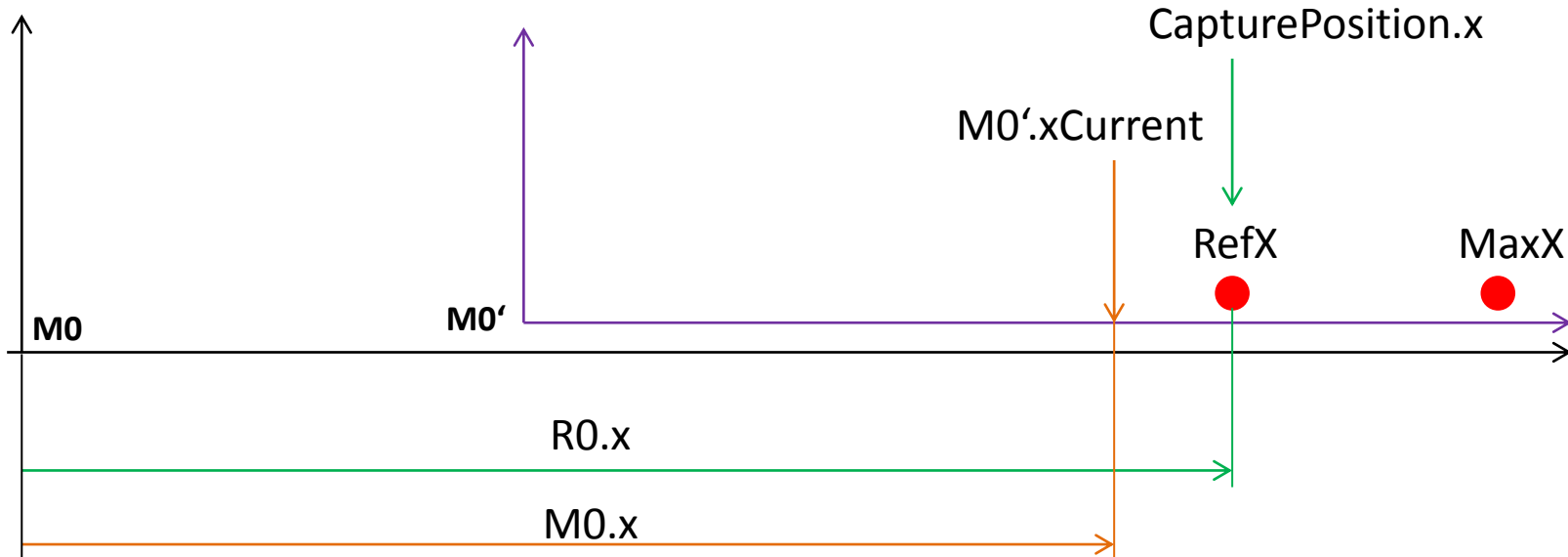
Referencing procedure

29.04.2012

Referencing

After power up of the AKKON CNC-Controller the system coordinate system has to be initialized performing referencing procedure. At this time the system does not know the position of the spindle. As the maximum distance of movement between each axis is known, every G00, G01-command that value is greater causes to enter a limit switch. E.g. if the spindle of a CNC-machine is able to move 300 mm over the x-axis, the command G00 X310 will result, that the limit switch MaxX will be triggered. AKKON supports a user configured **Referencing** using G-Code. Every time R0-movement will be triggered by the user, R0.txt will be processed and executed by AKKON.

Calculation of real machine coordinates on referencing



M0'...initialized coordinate system e.g. after startup of AKKON

M0 ...real machine coordinate system

Capture.x... M0'.x captured position on activation of reference switch

M0'.x current position of spindle head resp. machine table after referencing

$$M0.x = R0.x + M0'.x - CapturePosition.x$$

Calculation of real machine coordinates on referencing

; example for referencing procedure

N00010 G00 Z80 ; fahre ZMinAchse bis MaxZ

N00020 G00 x189 Y331 ; move x, y, MinAAchse in MaxX, MaxY

N00030 M101 C1 O2 M0 ; lösche Capture-Register aller Endschalter

N00040 M101 C2 O2 M0b00101100 ; Enable capturing of x, y, ZMinreference switch

N00050 F100 ; slow move over reference

N00060 G01 X180 Y310 ; move over reference switch x and y

N00070 G01 z79 ; move over reference switch z

N00080 M201 ; Referenzpunkt erreicht, berechne Maschinenkoordinate M0.x, M0.y, M0.z und gib eine Meldung aus

Parameters for M101-G-Code

C..Command: clear register

O..operation code: set all bits of selected register

M..bit mask for operation resp. value that has to be written : bit 0..7; example M0b00101100 : caputer ZMin, MinA, MaxY

Bit 0: MinX

Bit 1: MinY

Bit 2: MinZ

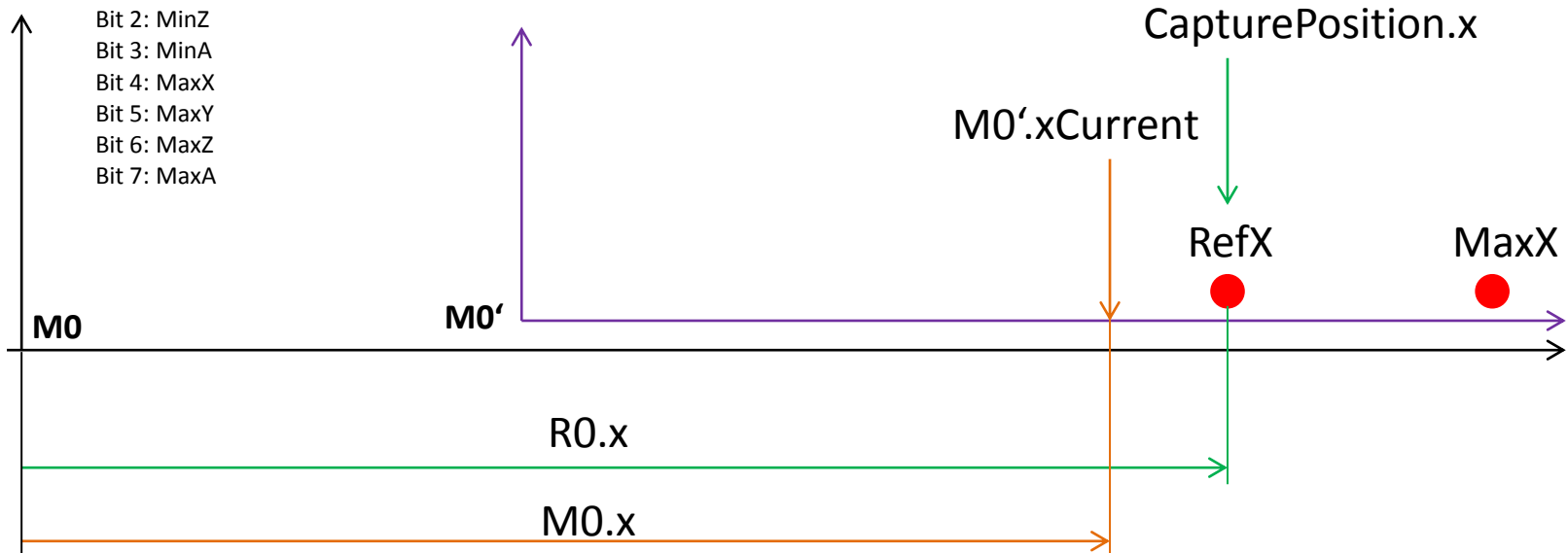
Bit 3: MinA

Bit 4: MaxX

Bit 5: MaxY

Bit 6: MaxZ

Bit 7: MaxA



M0'...initialized coordinate systemd e.g. after startup of AKKON

M0 ...real machine coordinate system

Capture.x... M0'.x captured position on activation of reference switch

M0'.x current position of spindle head resp. machine table after referencing

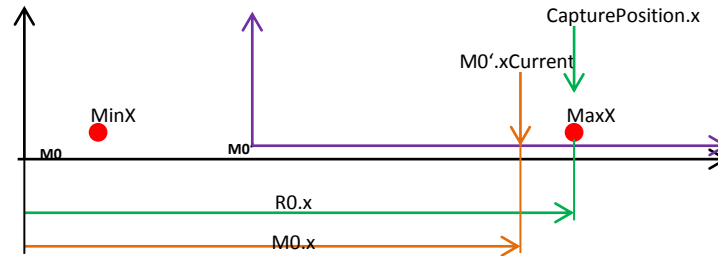
$$M0.x = R0.x + M0'.x - \text{CapturePosition.x}$$

Supported commands for limit switch configuration

| Command | Description | Example |
|--------------------------------|--|---|
| N00010 M101 C1 O2 M0bxxxxxxxx | set CAPTURED-bit of limit switches to a given value | N00010 M101 C1 O2 M0b00001100 (set captured-bits to binary 00001100) |
| N00010 M101 C2 O2 M0bxxxxxxxx | set CAPTURE-bit of limit switches to a given value | N00010 M101 C2 O2 M0b00001100 (set capture-bits to binary 00001100) |
| N00010 M101 C3 O2 M0bxxxxxxxx | Invert limit switch | N00010 M101 C3 O2 M0b00001100 (invert limit switches MinZ, MinA). Remark: This command will also be called on startup of AKKON and is configured in AKKON.ini but can also be used real time by program execution |
| N00010 M101 C4 O2 M0bxxxxxxxx | Set AXIS_LOCK_POS of limit switches to a given value | N00010 M101 C4 O2 M0b11110000 (Lock positive move on axes MaxX, MaxY, MaxZ, MaxA if limit switch is triggered) |
| N00010 M101 C5 O2 M0bxxxxxxxx | Set AXIS_LOCKED_POS of limit switches to a given value | |
| N00010 M101 C6 O2 M0bxxxxxxxx | Set AXIS_LOCK_NEG of limit switches to a given value | |
| N00010 M101 C7 O2 M0bxxxxxxxx | Set AXIS_LOCKED_NEG of limit switches to a given value | |
| N00010 M101 C10 O2 M0bxxxxxxxx | Capture limit switches immediately | N00010 M101 C10 O2 M0b01110000 (Capture limit switches MaxX, MaxY and MaxZ now). |
| N00010 M101 C11 O2 M0bxxxxxxxx | Set trigger edge for limit switch detection | N00010 M101 C11 O2 M0b00111100 (Trigger axes capture on positive edge of MaxX, MaxY, MinZ, MinA an the other on positive edge) |

Referencing - Example 1

Following example outlines one approach for referencing the coordinate system of a three axis CNC-machine. MaxX, MaxY, MaxZ will be used for referencing.
Assumption: After power up the spindle head is placed between the limit switch MinX - MaxY and the controller starts from power up consequently, the internal position of the x-axis of the controller is set to zero. The machine has maximum distance of movement of $x_{Max} = 180$ mm, $y_{max} = 320$ mm and $z_{Max} = 70$ mm.



Description:

- N00010: Machine moves maximum position of Z (N00010). Limit switch MaxZ is triggered, the machine stops at maximum after 70 mm.
- N00020: Machine moves to maximum position of x and y and stops at maximum at $x = 180$ mm and $y = 320$ mm.
- N00030: The capture register of all limit switches will be cleared. The system is now ready to capture the position if the related limit switch is triggered.
- N00040: Enable capturing: As the spindle head has already reached the position of limit switch MaxX, MaxY, MaxZ the capture event occurs.
- N00060: Slow move away from limit switch MaxX, MaxY
- N00070: Slow move away from limit switch MaxZ
- N00080: Configure limit switch MinX, MinY, MinZ as limit switch that locks spindle head if it is triggered
- N00090: Configure limit switch MaxX, MaxY, MaxZ as limit switch that locks spindle head if it is triggered
- N00100: Call "init coordinate system" and use value of capture registers of x-, y- and z- axis

Example for R0.txt

```

; Example for reference movement
N00010 G00 Z80 ; move to ZMax maximum, machine stops at maximum after z+ = 70 mm
N00020 G00 x189 Y331 ; move to MaxX and MaxY maximum (same as z-axis)
N00030 M101 C1 O1 M0 ; clear capture register of all limit switches
N00040 M101 C2 O2 M0b01110000 ; enable capturing of MaxX, MaxY, ZMax switches as reference
N00050 F100 ; slow move over reference
N00060 G01 X180 Y310 ; move to X and Y reference position
N00070 G01 z79 ; move to Z reference position
N00080 M101; C6 O2 M0b00000111 ; enable locking of negativ movement of axis MinX, MinY, ZMin for standard move
N00090 M101; C4 O2 M0b01110000 ; enable locking of positive movement of axis MaxX, MaxY, ZMax for standard move
N00100 M201 ; reference point reached, capture will be checked, M0x, M0.x, M0.z, M0.a be initialized and a message be output on screen
    
```

Remark 1: If not all specified reference switches are found on referencing then AKKON will output an error message on execution of command M201

Remark 2: Alternatively, limit switch MinX is used as reference and MaxX for locking of axis. In this case negative limitation of axis is no more monitored by the AKKON control system

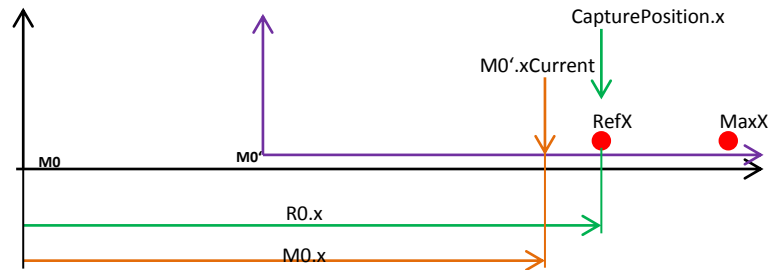
Referencing - Example 2

Following example outlines one approach for referencing the coordinate system of a three axis CNC-machine. MaxX, MaxY, MaxZ will be used for referencing.

Assumption: After power up the spindle head is placed between on the left / down, before MaxX, MaxY and MaxZ.

MinX- MinY, Min Z are closed to MaxX, MaxY, MaxZ and used as reference switches

MinX - MaxY and the controller starts from power up consequently, the internal position of the x-axis of the controller is set to zero. The machine has maximum distance of movement of $x_{Max} = 180$ mm, $Y_{max} = 320$ mm and $z_{Max} = 70$ mm. In thi



Description:

N00010: Machine moves maximum position of Z (N00010). Limit switch MaxZ is triggered, the machine stops at maximum after 70 mm.

N00020: Machine moves to maximum position of x and y and stops at maximum at $x = 180$ mm and $y = 320$ mm.

N00030: The capture register of all limit switches will be cleared. The system is now ready to capture the position if the related limit switch is triggered.

N00040: Enable capturing: As the spindle head has already reached the position of limit switch MaxX, MaxY, MaxZ the capture event occurs.

N00060: Slow move away from limit switch MaxX, MaxY

N00070: Slow move away from limit switch MaxZ

N00080: Configure limit switch MinX, MinY, MinZ as limit switch that locks spindle head if it is triggered

N00090: Configure limit switch MaxX, MaxY, MaxZ as limit switch that locks spindle head if it is triggered

N00100: Call "init coordinate system" and use value of capture registers of x-, y- and z- axis

Example for R0.txt

; Example for reference movement

N00010 G00 Z80 ; move to ZMax maximum, machine stops at maximum after $z+ = 70$ mm

N00020 G00 x189 Y331 ; move to MaxX and MaxY maximum (same as z-axis)

N00030 M101 C1 O1 M0 ; clear capture register of all limit switches

N00040 M101 C2 O2 M0b0000111 ; enable capturing of MinX, MinY, MinZ switches as reference

N00050 F100 ; slow move over reference

N00060 G01 X180 Y310 ; move to X and Y reference position

N00070 G01 z79 ; move to Z reference position

N00080 ; compare to Example 1: MinX, MinY and MinZ are not available for limiting movement because they are used as reference switches

N00090 M101; C4 O2 M0b01110000 ; enable locking of positive movement of axis MaxX, MaxY, ZMax, MinA for standard move

N00100 M201 ; reference point reached, capture will be checked, M0x, M0.y, M0.z, M0.a be initialized and a message be output on screen

AKKON CNC

Jog-mode configuration

12.04.2012

Setting up Jog mode parameters

Akkon supports three different Jog-modes that can be configured depending on resolution of each axis. Setup is done by modification of AKKON.ini

For every Mode 0 to 2 four parameters, relating to the x-, y-, z- and a-axis as well as a caption that describes the mode can be set by the user

E.g. Parameter JogMode1.Step2=10 specifies 10 steps for jog mode 1 on z-axis

Parameter caption will be shown in the status line of the control display in AkkonDesk if the related Jog-mode is selected by the user.

Following example set Jog mode 0 with a caption of 0.01 mm

Example configuration for Jog-Mode

```
; File: Akkon.ini
[JogInfo]
JogMode0.Caption=Jog 0.01
JogMode0.Steps0=1
JogMode0.Steps1=1
JogMode0.Steps2=1
JogMode0.Steps3=1
JogMode1.Caption=Jog 0.1
JogMode1.Steps0=10
JogMode1.Steps1=10
JogMode1.Steps2=10
JogMode1.Steps3=10
JogMode2.Caption=Jog 0.5
JogMode2.Steps0=500
JogMode2.Steps1=500
JogMode2.Steps2=500
JogMode2.Steps3=500
```