

## 1. Concept

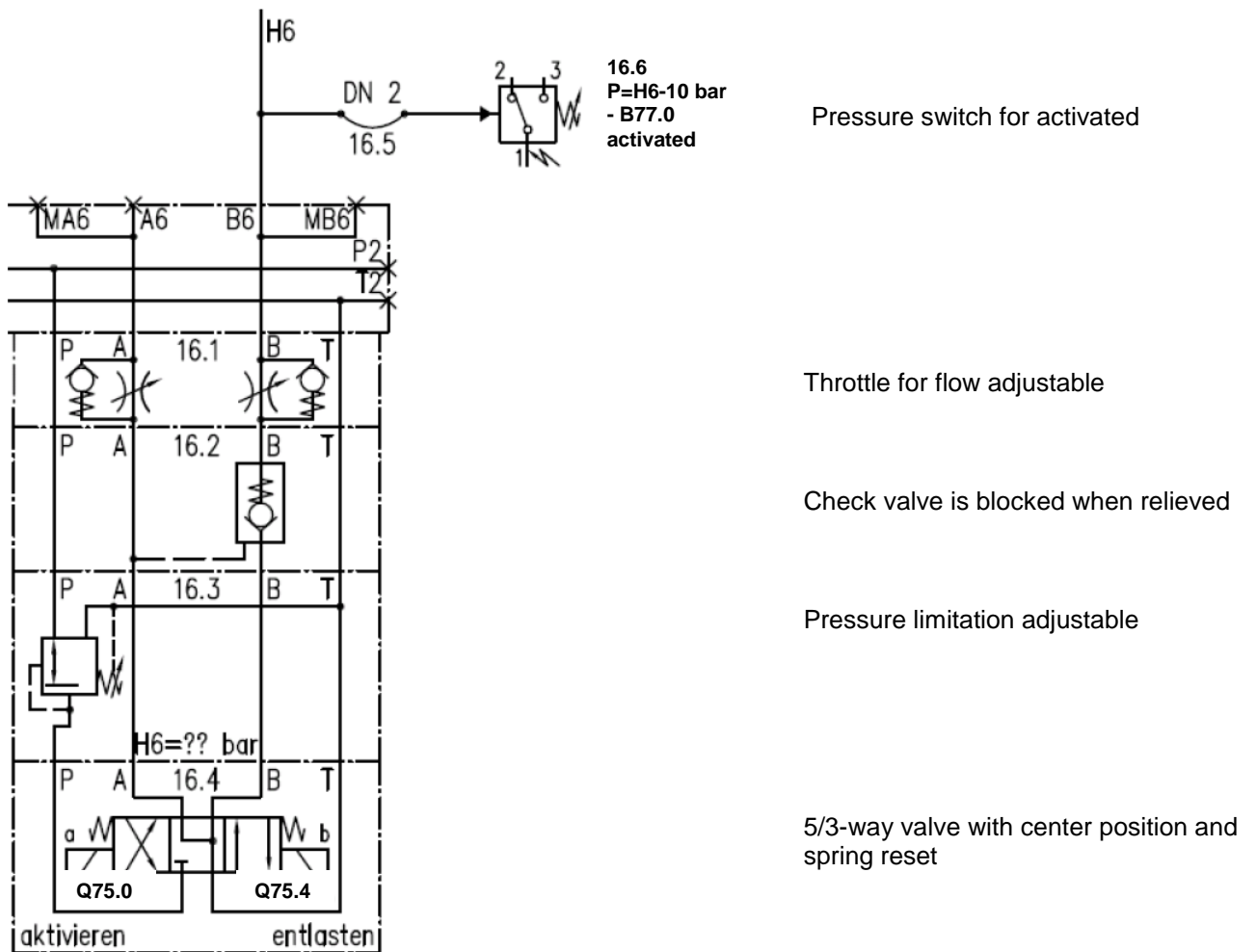
Clamping and unclamping sequences are programmed into NC cycles for a flexible adjustment to different clamping fixtures. The hydraulic and pneumatic functions are controlled and monitored via M and H functions in the PLC.

## 2. Basic functions

The hydraulic and pneumatic basic functions are displayed in here. Depending on design, these functions are available in various quantities, their function is always the same.

### 2.1. Hydraulic clamping function

Function ports are used for the hydraulic clamping functions. All ports perform the same neutral functions. The pressure on the port is enabled via "activate" and reduced by means of "relieve". In the currentless, center position, the port is locked by the check valve. The final function is determined by the application in the clamping fixture.



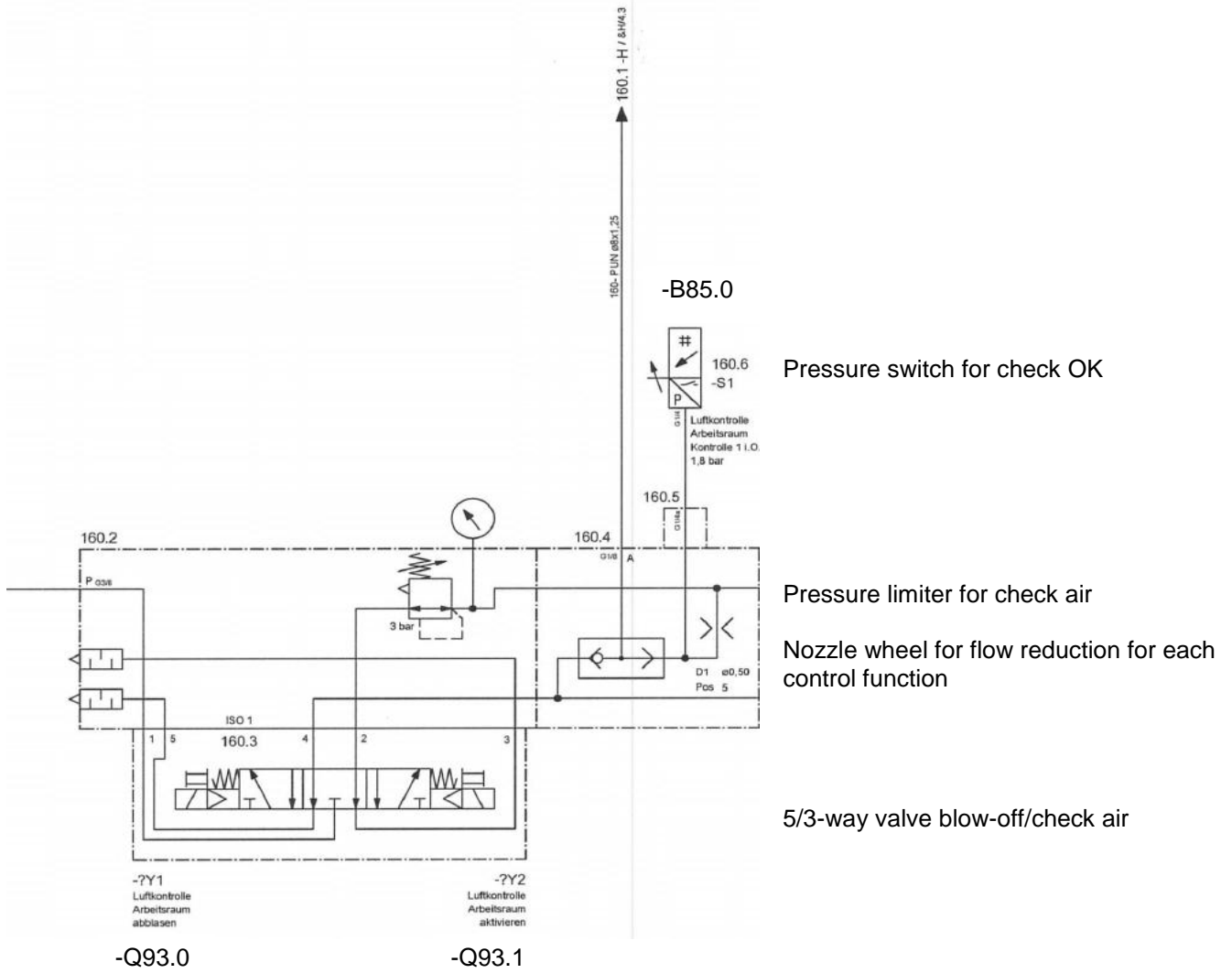
in center position.

When power is off, the valve is always

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### 2.2. Blow-off and pneumatic control function

The same air ports are used for blow-off and for checking. For blow-off, full air pressure is enabled, for control, it is reduced to 3 bar. Switchover takes place simultaneously for all air ports. Each line can be adjusted via a flow limiter and a pressure switch.



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### 3. M / H functions

The functions are called with extended M functions in the NC. All functions that are programmed in an NC block are started at the same time. Machining of the next NC block is suppressed with read-in disable until all M functions have been completed.

#### 3.1. Hydraulic functions

For the valve/ports, M functions 331 to 340 are programmed. The extension determines the valve position, e.g. for port H4:

<b>M0=334</b>	<b>H4 blocked</b> center position
<b>M1=334</b>	<b>Activate H4</b> Position A
<b>M2=334</b>	<b>Relieve H4</b> Position B
<b>M3=334</b>	<b>Activate H4</b> Position A without read disable
<b>M4=334</b>	<b>Relieve H4</b> Position B without read disable

#### 3.2. Suppressing read-in disable

If machining of the next NC block is not to be disabled for a clamping function, this function can be started with the extension 3 / 4 without read-in disable. This allows performing clamping/unclamping and other functions or axis positioning simultaneously. To check whether the end position of the asynchronously started clamping function has been reached, this is repeated with read-in disable and thereby synchronized.

#### 3.3. Pneumatic checks

For control functions, M functions 351 to 354 are programmed. The extension determines whether the check operates as location check.

e.g. for port Lu2:

**M1=352 Activate Lu2 check or M3=352 Activate Lu2 check without read-in disable**

As soon as a control function is active, check air is activated. If "Blow-off" is active at the same time, the control function takes precedence. Once the control function is complete, it is turned off.

#### 3.4. LOCATION CHECK

The location check corresponds to the pneumatic check and is also programmed via M functions 351 to 354. For differentiation the extension M2=35x is used. The location check becomes active only if a workpiece is present.

e.g. for port Lu1:

**M2=351 Activate Lu1 as location check or M4=351 Activate location check without read-in disable**

Status data can be changed and adapted in the fixture menu.

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### 3.4.1. M358 – setting location pad to OK

For start enable, the workpiece must be clamped and the location pad set to OK. In the following case, location IO must be set to M358.

- Clamping fixture has no location check
- Clamping without workpiece

### 3.4.2. M359 – Reclamping if location pad NOK

M0=359 ASUP call-up; M1=359 Activate call-up without ASUP

The location check inside the work area can be performed with reclamping. For this purpose, M359 is programmed in addition to the location check in the NC block.

#### **M2=353 M0=359 Activate Lu3 as location check with clamping repeat**

If the location check does not report within runtime, the cycle AS\_WP\_RECLAMP is called up via ASUP. A repeated location error leads to a standstill.

### 3.5. Pneumatic functions

Further functions for control of air valves are programmed with M function 350 and extensions:

**M1=350 Blow-off on**

**M2=350 Check air on in preparation**

The control air pre-activated via M2=350 is deactivated again after a programmed control function. No runtime monitoring occurs.

### 3.6. Activate end position

Since the function of the individual ports is not predefined, the "clamped"/"unclamped" position at the end of the clamping/unclamping sequence needs to be explicitly set. This is achieved via the M-Function M330.

**M1=330 Workpiece clamped**

**M2=330 Workpiece released**

The activated end position is subsequently monitored. It is cleared once a pertaining M function is called, or an end position error is output when a pressure switch is changed.

### 3.7. Times

Extended H functions were used for the times, because this allows indicating real values in seconds in the extension.

Runtime monitoring is activated for all functions. Acknowledgement is required within this time, otherwise a runtime error is displayed.

**H91=t.ttt delay time in seconds**

An additional delay (debouncing time) can be programmed for hydraulic clamping functions

**H92=t.ttt debouncing time in seconds**

The programmed times are only applicable for functions programmed in the same block. After that, times from the machine data apply again.

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### 4. NC cycles

The various clamping and unclamping sequences are programmed in cycles.

AS Application subroutine  
WP Workpiece

AS\_WP\_CLAMP Clamp workpiece  
AS\_WP\_UNCLAMP Unclamp workpiece  
AS\_WP\_RECLAMP Workpiece repeat clamping

### 5. Attachment - Error messages

The specified error texts apply to clamping sequences in the work area.

Errors with characters printed in *italics* can occur for various similar errors. The *italic text* is then replaced by the text of the active error. If several errors of the same type occur at the same time, the text for the lowest address is displayed.

#### 5.1. Runtime error

Run time errors occur if the function is not acknowledged within the specified runtime.

- 700412** **+HY1-B77.2/Mx=333: Runtime activate workpiece clamping**  
Pressure switch B77.2 was not activated during activation of function port H3.
- 700413** **+HY1-B77.3/Mx=334: Runtime relieve workpiece clamping (must be 0)**  
Pressure switch B77.3 was not released during relieving of function port H4.

#### 5.2. End position error

End position errors occur when the pressure switch is released during an active function or if it signals during a relieved function.

- 700410** **+HY1-B77.2/Mx=333: End position workpiece clamping activated**  
Pressure switch B77.2 was released when function port H3 was activated.
- 700411** **+HY1-B77.3/Mx=334: End position workpiece clamping relieved (must be 0)**  
Pressure switch B77.3 was active when function port H4 was relieved.

#### 5.3. Signal for location check

- 700432** **+MZ-B85.1/Mx=352: Location check workpiece clamping**  
Location check LU2 with pressure switch B85.1 not acknowledged - repeat clamping is active.

#### 5.4. General errors

- 700429** **Error M-function 351..354 (control function)**  
[[[  
SER]]] One of the M functions for pneumatic checks has been called incorrectly, valid extensions are M1= for normal control, M2= for location check.
- 700430** **Error M function 330 (end position)**  
[[[  
SER]]] M function 330 was called while a clamping function is still active; an extension M3= or M4= for execution without read-in disable may have been used.
- 700431** **Error, M function 331...338 (clamping/unclamping function)**  
[[[  
SER]]] One of the M-functions for hydraulic function ports has been called incorrectly, valid extensions are M1= activate, M2= relieve, M0= center position and/or M3=/M4= for activate/relieve without read-in disable.

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