

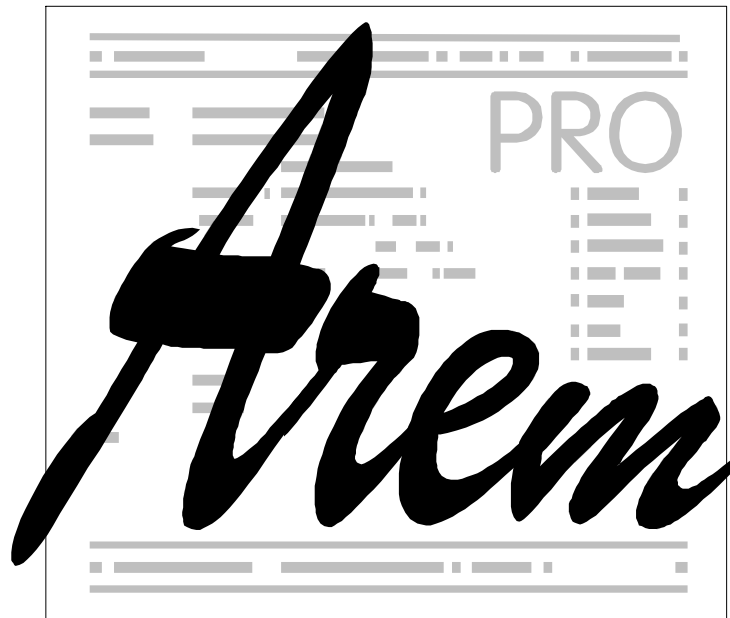


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AHW886 Operating manual

25.2.2013



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1. Basic description

1.1. AHW886 hardware/firmware ver. - 2.1



A manual handwheel AHW886 is delivered with the Cnc886 system. It allows comfortable operation at manual pre-travels of the machine tool and smooth change of feed in automatic mode. Thanks to flexible cable with maximum length 6m it covers the entire working area of most machines.

The AHW886 is designed as an intelligent peripheral of the control computer. Besides the circuit of the Emergency stop, which is solved by the separate pair of conductors, all information is being transferred by the serial line. The transmission is controlled on the side of the AHW886 by inbuilt microcomputer, on the side of the control system it is the Cnc886 program. For communication with the operator AHW886 contains:

- Two-line alphanumeric backlit LCD display with 2x16 characters
- Rotary knob with 100 detent positions, equipped with incremental position sensor. We will call it "wheel"
- Six control buttons

The display shows information sent by the control system to the AHW886. Besides the initial message,

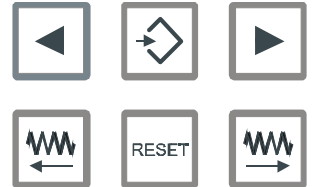
**HandWheel CNC886
AREM PRO ver-2.1**

generated by AHW886. All other messages are sent by the control system and they reflect the Cnc886 program status, but not the status of AHW886. So, if the AHW886

displays an error, it is not an error of AHW886, but it is an error detected by the control system.

The wheel under the display serves in manual modes for controlling position of the selected axis. In the mode of the Automatic program run it serves for feed control.

Control buttons have different functions in different situations. In principle, it is possible to say that the upper three buttons serve as selection buttons (selection of mode, function, axis etc.). The lower buttons are operational (start/stop movement, program etc.).



1.2. Safety at work with AHW886

Following precautions for operator's safety were made on the side of the control system:

- Manual movement invoked by the AHW886 may be stopped by pressing the RESET button in the Cnc886.
- Manual movement invoked from the panel may be stopped by pressing the RESET button on the AHW886.
- After completion of the automatic program operation the AHW886 always ends in the mode selection menu.
- After two minutes without operator's activity on the AHW886 the system returns to the mode selection menu.
- Interruption of communication with AHW886 stops the manual movement.

Machine control operated by the AHW886 and the Cnc886 panel simultaneously by two persons is in praxis a life endangering machine operation.

Considering the fact, that the AHW886 cable allows the machine operator to initiate movement from any place of the workplace, the operator must particularly observe basic safety rules stated in machine operating conditions.

1.3. AHW886 operation versions

The version of operation is the version of the Cnc886's usage of the AHW886. The function of pressing button is not implemented in the AHW886 itself. Meaning that different "operation versions" do not necessarily need a new version of AHW886 hardware or firmware.

At the beginning there was only one version 2.4 and other versions were not planned. The practice showed that new functions would be appreciated especially in cases of special technologies. Therefore the new version 2.5 was prepared.

From this point the choice of the version is made by Cnc886 configuration parameter

SysWheelVer = 24 ; Version 2.4
resp.

SysWheelVer = 25 ; Version 2.5

The default value of the parameter is 24.



2. AHW886 operation version 2.4

2.1. Cnc886 states

Available AHW886 control functions depend on the Cnc886 status. Some states do not allow any control by the handwheel. Following table shows the possible Cnc886 states, related AHW886 display and available functions.

Status	AHW886 displays	AHW886 control available
Power Off	Switched off Wheel - ver. 2.4	No control
Initialization	Initializing Wheel - ver. 2.4	No control
Nor referred	Not referred Wheel - ver. 2.4	No control
Referencing	Referencing Wheel - ver. 2.4	No control
Loading	Loading program Wheel - ver. 2.4	No control
Loaded	Program loaded Wheel - ver. 2.4	No control
Error	Error !! Wheel - ver. 2.4	No control
Running	See chapter 2.2	Stop, Reset, Feed
Stopped	See chapter 2.2	Start, Reset, Feed
Stopped by M0	See chapter 2.2	Start, Reset, Feed
Ready	See chapter 2.3	All
Manual bin	See chapter 2.3	All
Manual move	<- ax -> s=0.100 >>> X= 134.000	Reset, Continue move

2.2. AHW886 in “Running”, “Stopped” and “Stopped by M0” states

If the technological program is started, the AHW886 display shows current status, value of feed coefficient and text of the currently entered line (or its part).

```
Auto:      F= 50%  
N1203 G1 X150 Y1
```

While the program is running the Cnc886 may be in the „Stopped“ status or in „Stopped by M0“. In this situation the display shows:

```
Stop:      F= 50%  
N1203 G1 X150 Y1
```

```
M0:        F= 50%  
N1203 G1 X150 Y1
```

The display also shows the status of **SPEED** button (in new versions of Cnc886 named **G0 x0.1** button) of the control system. If pressed, the letter **F** at the percentage of feed is replaced by lower letter **f**.

```
Auto:      f= 50%  
N1203 G1 X150 Y1
```

You can control the program operation by the AHW886 as follows:

Turning the wheel changes the feed coefficient with the 1% step in the range from 0% up to 150%. Setting the value to 0% completely stops moving of axes.



Decreases feed coefficient by 10 %



Increases feed coefficient by 10 %



Changes status of the **G0 x0.1** button of the control system



The same as the START+ button on the panel of Cnc886



Program reset



Stops the program the same way as the Stop button on the panel of Cnc886

2.2.1. AHW886 in “From line” and “From Position”

It is also possible to control dialogs in the **From** mode and in the **FromPos** mode. After starting the program Cnc886 finds the initial point and you will be asked about initiation of M functions and about the pre-travel. At this moment AHW886 buttons function as follows:



Reduces the feed coefficient by 10 %



Increases the feed coefficient by 10 %



Changes state of the **G0 x0.1** button of the control system



The same as **START+** button on the Cnc886 panel and **Yes** answer







Program reset



Answer **No**

The most frequent procedure is as follows:

1.  Start the program in the selected mode
2.  Answer **Yes** to the question on function initiation
3.  Answer **Yes** to the question on the pre-travel
4.  Initiate continuation of the program

2.3. AHW886 in “Ready” status

If the Cnc886 program is in Ready status, it is possible to use the AHW886 for initiation of the program or to control individual axes manually. There is a dialog for selection of the required operation. We will call it „Mode selection level“.

The system of handwheels control in Ready status is organized in several levels, because the number of buttons on the AHW886 is limited. A similar system is used on older cell phones, where on each level we move between couple of selection entries that may lead to another lower level. To go to the previous higher level we usually press the Reset button.

2.3.1. Mode selection level

The basic level of the selection tree is a „Mode selection dialog“. The display shows:

Ready
Auto< >Manual



Selects automatic mode



Selects manual mode

Other buttons do not invoke any action. Also turning the wheel has no effect. This mode is “save” mode.


2.3.2. Automatic mode

The display shows:

Ready: F=100%
%1 {Program XYZ}

The first row shows status and value of the feed coefficient and status of the G0 x0.1 button. The lower one shows the first row of the active program. In this status it is possible to set the feed coefficient by using the wheel and initiate the program with



the button , which has START+ function.

The RESET button of the AHW886 returns you back to the „Mode selection dialog“.


2.3.3. Manual mode

In manual mode you can use the AHW886 to move individual axes of your machine. You can also perform movements in “vector” direction.

The manual mode has three levels.

1. Axis selection level
2. Step selection level
3. Axes rose level

2.3.4. Manual mode - Axis selection level

After pressing  in „Mode selection level“ we get to Axis selection level. On the display you should see:

```
<-ax->   s=0.100
<->   x=  134.000
```

The title **<- ax ->** indicates that the axis for movement shall be selected by arrow buttons. The **ax** indicates the Axis selection level.

s=0.100 shows the step in millimeters. It is used in wheel movements.

The lower row shows the name of the selected axis and its current position.

The step ‘**s**’ also controls the speed of continuous manual movements. Following table shows the dependence between the step value and manual movement speed coefficient. The manual movement speed is the result of multiplication of the coefficient and the speed set for the actual axis in the configuration file.

s=1.000	10x
s=0.100	1x
s=0.010	0.1x
s=0.001	0.01x

You can control the program operation by the AHW886 as follows:

Turning the wheel changes position of the axis with the preset step.



Selection of the previous axis



Enter the „Step selection level“



Selection of the following axis



The same as the START+ button in the tab Manual Move.





Access to the “Mode selection dialog“



The same as the START- button in the tab Manual Move

It is also important to notice the difference between button movements and wheel

movements when rotational axis (A, B and C) is selected. Pressing  or  moves only a chosen axis. So the tool moves around the motors axis. Turning the wheel evokes rotational movement around the tool tip.

In water jet machines the tool tip is the point of streams input into the material. We will call this point **nozzle tip**. Separating those two ways of moving the rotational axes eases the positioning of the machine.

At the manual movement of the axis invoked by the AHW886 or from the panel of Cnc886 the display shows movement direction of chosen axis:

```
<-ax->    s=0.100  
>>>  x= 134.000
```

2.3.5. Manual mode - Step selection level

In the step selection mode the display shows:

```
<-st->    s=0.100  
<->  x= 134.000
```

The upper row shows current step. The title **<- s ->** indicates the step selection level and that arrow buttons change the step. The lower row shows the name of the currently selected axis and its current position.

You can control the program operation by the AHW886 as follows:

Turning the wheel changes position of the axis with the preset step.



Selection of previous step



Access to another axes rose level



Selection of the following step



The same as the START+ button in the tab Manual Move.



Access to the axis selection level



The same as the START- button in the tab Manual Move.



Movements use the same rules like in the axis selection level.

2.3.6. Manual mode - Axes rose level

A	Z	B
X*	Exit	Y



This level provides you quick access to any axis. Selected axis is marked with *. Now you can move it with the wheel. Step was selected in the „Step selection level“.

The axes names are placed on the display in the same pattern, like buttons on the



AHW886. That means, that the  button will select Z axis, the  selects the Y axis etc.





button moves you back to the „Step selection level“.

Pressing  and  simultaneously means „insert point“ in the case, that the system is equipped with TeachIn module. The display will respond

```
<<< Point >>>  
<<< inserted >>>
```

Pressing  and  simultaneously invokes continuous movement in the „tool direction“ away from the material.

Pressing  and  simultaneously invokes continuous movement in the „tool direction“ towards the material.







3. AHW886 operation version 2.5

Version 2.5 is based on the version 2.4 . Most functions are same as in version 2.4. Some functions are simplified, some are added. From the version 2.5 it is possible to have “technology dependent” functions on AHW886. Meaning that different functions can be available for milling machine and different for waterjet machine.



To add new functions it was necessary to overcome the problem of limited buttons number on AHW886. We started to use “two button” functions. This approach was already used in version 2.4 in “vector move” and “insert point” in axes rose level. “Two button” function is evoked by pressing two buttons simultaneously. Because you can never press two buttons really simultaneously, these functions expect that you will press one button first, hold it and then press another one. The same method you use when you press Shift key on the computer keyboard and then the letter.

Here is the brief list of changes in comparison with version 2.4:

- The feed coefficient can not be changed by  and  buttons any more. Only the wheel can be used for that. The  and  buttons are reserved for other functions.
- In the “Axis selection level” the item “Vect” was added.
- Point insertion for TeachIn module is available in “Axis selection level”.
- The “Step selection level” was omitted. Step selection is made by “two button” function.
- Function “Set zero point” was implemented for waterjet machines.
- Function “Set cutting height” was implemented for waterjet machines.
- Function “Change cutting height” during the cutting was implemented for waterjet machines.



3.1. AHW886 in “Running”, “Stopped” and “Stopped by M0” states

The function is very similar to the version 2.4. Only the  and  buttons are now reserved for technology dependent functions.

You can control the program operation by the AHW886 as follows:

Turning the wheel changes the feed coefficient with the 1% step in the range from 0% up to 150%. Setting the value to 0% completely stops moving of axes.



Technology dependent



Technology dependent



Changes status of the **G0 x0.1** button of the control system



The same as the START+ button on the panel of Cnc886




Program reset



Stops the program the same way as the Stop button on the panel of Cnc886

3.1.1. Functions for waterjet machines

3.1.1.1. Controlling the cutting height

By pressing and holding  you can control the cutting height by the wheel in steps of 0.1mm. This is true only when the manipulating Z axis is allowed. You can not use it while cutting in 3D/5AX programs or when the ProgresJet is on.

Height s=0.100
<-> z= 34.000

3.1.2. AHW886 in “From line” and “From Position”

The function is same as in version 2.4.

It is possible to control dialogs in the **From** mode and in the **FromPos** mode. After starting the program, Cnc886 finds the initial point and you will be asked about initiation of M functions and about the pre-travel. In this moment AHW886 buttons function as follows:



Technology dependent



Technology dependent



Changes state of the **GO x0.1** button of the control system



The same as START+ button on the Cnc886 panel and **Yes** answer







Program reset



Answer **No**

The most frequent procedure is as follows:

1.  Start the program in the selected mode
2.  Answer **Yes** to the question on function initiation
3.  Answer **Yes** to the question on the pre-travel
4.  Initiate continuation of the program

3.2. AHW886 in “Ready” status

If the Cnc886 program is in the Ready status, it is possible to use the AHW886 for initiation of the program or to control individual axes manually. There is a dialog for selection of the required operation. We will call it „Mode selection level“.

The system of handwheels control in Ready status is organized in several levels, because the number of buttons on the AHW886 is limited. A similar system is used on older cell phones, where on each level we move between couple of selection entries that may lead to another lower level. To go to the previous higher level we usually press the Reset button.

3.2.1. Mode selection level

The basic level of the selection tree is a „Mode selection dialog“. The display shows:

Ready
Auto< >Manual



Selects automatic mode



Selects manual mode

Other buttons do not invoke any action. Also turning the wheel has no effect. This mode is “save” mode.


3.2.2. Automatic mode

The display shows:

Ready: F=100%
%1 {Program XYZ}

The first row shows status and value of the feed coefficient and status of the G0 x0.1 button. The lower one shows the first row of the active program. In this status it is possible to set the feed coefficient by using the wheel and initiate the program with



the button , which has START+ function.

The RESET button of the AHW886 returns you back to the „Mode selection dialog“.


3.2.3. Manual mode

In manual mode you can use the AHW886 to move individual axes of your machine. You can also perform movements in “vector” direction.

The manual mode has two levels.

1. Axis selection level
2. Axes rose level

3.2.4. Manual mode - Axis selection level

After pressing  in „Mode selection level“ we get to Axis selection level. On the display you should see:

```
<-ax->   s=0.100
<->   x= 134.000
```

The title <- ax -> indicates that the axis for movement shall be selected by arrow buttons. The **ax** indicates the Axis selection level.

s=0.100 shows the step in millimeters. It is used in wheel movements.

The lower row shows the name of the selected axis and its current position.

The step ‘s’ also controls the speed of continuous manual movements. Following table shows the dependence between the step value and manual movement speed coefficient. The manual movement speed is the result of multiplication of the coefficient and the speed set for the actual axis in the configuration file.

s=1.000	10x
s=0.100	1x
s=0.010	0.1x
s=0.001	0.01x

You can control the program operation by the AHW886 as follows:

Turning the wheel changes position of the axis with the preset step.



Selection of the previous axis



Enter the „Axes rose level“ or initiate “two button” function



Selection of the following axis





The same as the START+ button in the tab Manual Move.



Access to the “Mode selection dialog“



The same as the START- button in the tab Manual Move.

It is also important to notice the difference between button movements and wheel movements when rotational axis (A, B and C) is selected. Pressing  or  moves only a chosen axis. So the tool moves around the motors axis. Turning the wheel evokes rotational movement around the tool tip.

In water jet machines the tool tip is the point of streams input into the material. We will call this point **nozzle tip**. Separating those two ways of moving the rotational axes eases the positioning of the machine.

At the manual move of the axis invoked by the wheel or from the panel of Cnc886 the display shows direction of move of moving axis:

```
<-ax->   s=0.100
>>>  x=  134.000
```

3.2.4.1. "Vect" axis

If the machine has rotational axes A, B or C, you will have an axis "Vect" available in the axes list. To move machine in the "Vect" axis means to move it in the direction of the tool.

As an example imagine that your tool is oriented vertically. The "Vect" will move in Z axis. In order to be consistent we chose the positive direction as "away from material". So in the vertical case the positive movement will be same as positive movement in axis Z.

When you select the "Vect" axis, the display will always show the position 0.000 and sets the actual position as a starting position. When you move the display will show you the distance from the starting position.


```
<-ax->   s=0.100
>>Vect=   4.000
```

3.2.4.2. Step selection

Step selection is in version 2.5 implemented as a "two button" function.

To select next lower step, press the  first, hold it and then press .



To select next higher step, press the  first, hold it and then press .

After pressing  the AHW886 displays the star "*" in the first line to inform you, that you can use "two button" function.

```
<-st-> * s=0.100
<->  x=  134.000
```

When you do not press  or  buttons and simply release the  button, you enter the Axes rose level.

3.2.4.3. Point insertion



Pressing  and  simultaneously means „insert point“ in the case, that the system is equipped with TeachIn module. The display will respond



```
<<< Point >>>
<<< inserted >>>
```

3.2.4.4. Functions for waterjet machines



Other “Two button” functions are prepared for waterjet machines. They are “Set start point” and “Set cutting height”.

Set start point

When you have positioned your nozzle in X,Y above the point you want to have as an (0,0) point, select the X or Y axis in the “Axis selection level” and use  + . Both X and Y will be set to zero.

Remember, that you have to press  first and then .

Set cutting height



Select Z axis (or Zb) in the “Axis selection level” and use  + . The axis will be set to 0. The cutting height will be set as well. This function solves both zero position setting of Z for 3D/5AX programs and cutting height setting for 2D programs.


3.2.5. Manual mode - Axes rose level



A	Z	B
X*	Exit	Y

This level provides you quick access to any axis. Selected axis is marked with *. Now you can move it with the wheel. Step was selected in the „Step selection level“.

The axes names are placed on the display in the same pattern, like buttons on the



AHW886. That means, that the  button will select Z axis, the  selects the Y axis etc.



 RESET button moves you back to the „Axis selection level“.

Pressing  and  simultaneously means „insert point“ in the case, that the system is equipped with TeachIn module. The display will respond

```
<<< Point >>>
<<< inserted >>>
```



Pressing  and  simultaneously invokes continuous movement in the „tool direction“ away from the material.

Pressing  and  simultaneously invokes continuous movement in the „tool direction“ towards the material.