



# HEIDENHAIN

User's Manual

## IOB 49

English (en)  
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## **Operating Instructions**



## General Information

### **Connecting the IOB 49 to X10 for executing switching functions (milling) or controlling the constant surface speed CSS (turning)**

When the IOB 49 is connected to the ND 780, the functionalities described above are available.

For information on the installation of the IOB 49 in an electrical cabinet, the connection technology and the wiring, please refer to the Operating Instructions. The Operating Instructions are included with every position display unit, or can be requested from HEIDENHAIN.

The position display unit automatically recognizes when an IOB 49 is connected and displays the CSS SETUP option or the SWITCHING OUTPUTS option in the INSTALLATION SETUP menu. These options can be used to configure all functions of the switching unit.



# I – 1 Execution of Switching Functions

Switching functions can only be executed when the position display unit is configured for milling applications.

If you want to use both the IOB 49 and the KT 130 edge finder at the same time or if you want to transmit measured values via the external switching output, the distribution cable with ID 532 909-01 is required.

## Switching inputs

The IOB 49 provides three inputs that are used to zero the actual value of the assigned axis. A low-to-high transition at the input causes the value for that axis to be set to zero.

## Switching outputs

The switching outputs consist of eight (integrated) relays that are activated depending on the position. The relays can be configured to activate when a position display reaches a specific value or within a specified range of zero. The ninth output relay indicates readiness.

Select SWITCHING OUTPUTS from the INSTALLATION SETUP menu to open the SWITCHING OUTPUTS table in which the configuration of the eight outputs is stored. If you want to change the configuration of an output, select it with the arrow keys and press ENTER to confirm your selection. This opens the OUTPUT SETTINGS form in which you define the switching conditions. To reset a relay, select the relay in the table and press the CLEAR RELAY soft key.

SWITCHING OUTPUTS	
1:	X < 10.000 ↓, POINT, ON
2:	Y < 5.000 △, RANGE, ON, 1.0 SEC
3:	
4:	
5:	
6:	
7:	
8:	

	CLEAR RELAY		HELP
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Fig. I.1

- ▶ The CONDITION field is used to assign an axis to the output and to specify whether the axis position is an actual-value or distance-to-go position. You also specify the position display value at which the relay is activated, and the required condition.
- ▶ The POINT/RANGE field is used to define whether the conditions refers to a point on the axis or refers to a range about zero.
- ▶ The OUTPUT field is used to specify the relay operation when the switching condition is met. When the condition is met, the relay is turned OFF or ON.

D:0 | T:1 | F: 0 | 0:00 | MM | | |

<b>OUTPUT SETTINGS (1)</b>		Press an axis key to select the axis.  Press the soft keys to select the condition and / setting.	
CONDITION			
X <	10.000		
POINT/RANGE	RANGE		
OUTPUT			
ON	0.5 SEC		
CONDITION []			HELP

Fig. I.2 OUTPUT SETTINGS form

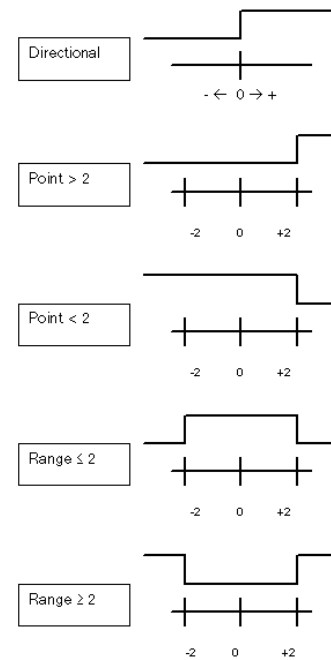




Fig. I.3 Possible switching states of the relays





In PULSED mode, the relay is activated (ON or OFF) for a specific period of time. After the period has timed out, the relay is deactivated. The pulse time is 0.1 to 999 seconds.

 The time period begins whenever the switching condition transitions from FALSE to TRUE. If the switching conditions transitions to TRUE before the period has timed out, the timer will start over.

 The switching functions cannot be used for coupled axes or for axes with backlash compensation.

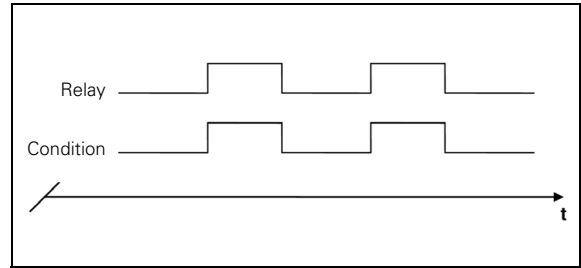


Fig. I.4 CONTINUOUS mode

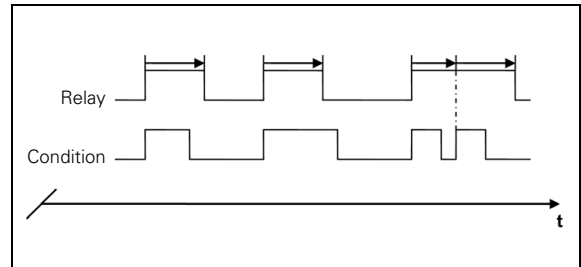


Fig. I.5 PULSED mode



## I – 2 Controlling the Constant Surface Speed (CSS)

In CSS mode, a constant surface cutting speed can be maintained on a lathe. The following functions are available:

- CSS mode: The DAC output signal provides constant surface speed by adjusting the spindle speed as the diameter (radius) of the workpiece changes.
- Direct entry of spindle speed: The DAC output signal sets the spindle speed based on the value entered via the numeric keypad.
- Speed limits: The user may set a safe operating range (minimum and maximum speeds) for spindle speed.
- Gear selection: Three different gears can be specified for varying the relation between the actual speed and the DAC output signal.



## Configuration of CSS

The spindle control configuration parameters are set up in the INSTALLATION SETUP menu. Select the CSS SETTINGS parameter to open the associated input form.

- ▶ The CSS ON/OFF CONTROL field is used to specify whether the CSS mode is operated by soft key or by an external hardware signal.
- ▶ The current gear may be selected by local control (MANUAL via CSS / DIRECT RPM in the JOB SETUP menu) or remote control (EXTERNAL; via switches in the machine gear). This is defined in the CSS GEAR SELECT field.
- ▶ The VOLTAGE OFFSET function is used to adjust for any inherent offset in the DAC signal. Using a voltmeter, measure the actual voltage at the DAC output. Press INCREASE or DECREASE to adjust the offset until the output is 0 V. The offset range is limited to 0 to 50 (approximately 0 to 122 mV).
- ▶ The VOLTAGE / RPM fields are used to establish the relationship between the DAC output signal (0 to 10 V) and the spindle speed. The minimum and maximum limits for each gear are entered.

If the position display of the third axis is configured to be used for the spindle speed, the rpm in the SETTING field can be set to the current spindle speed by pressing the TEACH soft key.

To set a specific spindle speed, the DAC output  $S_{Out}$  uses this linear relationship to determine the corresponding output voltage  $V_{Out}$ :

$$V_{Out} = 10 \cdot (S_{Out} - S_0) / (S_{10} - S_0) + V_{Offset}$$

Press ENTER to save the parameters and exit the input form. Press the C key to exit without saving the changes you made.

D:0   T:1   F: 0   0:00   MM	
<b>CSS SETTINGS</b>	
CSS ON/OFF CONTROL	Select <b>SOFT KEY</b> to control CSS from the readout soft key.
<b>SOFT KEY</b>	
CSS GEAR SELECT	
MANUAL	Select <b>EXTERNAL</b> to control CSS through an external hardware signal.
VOLTAGE OFFSET	
3	
SOFT KEY EXTERNAL	
	HELP

Fig. I.6 CSS SETTINGS (1) form

D:0   T:1   F: 0   0:00   MM	
<b>CSS SETTINGS</b>	
VOLTAGE/RPM (1)	For the gear selection shown in parenthesis, enter the spindle speed when the CSS output is at 0V.
0 V: <b>100</b> RPM	
10 V: 3000 RPM	
VOLTAGE/RPM (2)	
0 V: 500 RPM	
10 V: 5000 RPM	
	NOTE      HELP

Fig. I.7 CSS SETTINGS (2) form



## CSS operating mode

The operating parameters are set in the CSS / DIRECT RPM form. Press the CSS SETUP soft key to open the form or select the parameter from the JOB SETUP menu.

- ▶ The SETTINGS field is used to select the mode of operation and the control settings. The spindle is controlled by selecting CSS or by entering the spindle speed directly. The values to be entered depend on the selected option.

If CSS was selected to maintain a constant surface speed, the surface speed entered with the numeric keys is maintained. As the diameter of the part changes, the spindle speed will be adjusted.

To set a specific spindle speed, select DIRECT / RPM and enter the value with the numeric keypad.

If the position display of the third axis is configured to be used for the spindle speed, the rpm in the SETTING field can be set to the current spindle speed by pressing the TEACH soft key.

Select OFF when spindle control is not needed.

- ▶ The GEAR SELECTION field is used to manually enter the operating gear with the numeric keypad.



If the gear control parameter in INSTALLATION SETUP is set to EXTERNAL, the field will show the current gear selection based on the external inputs. The field can then not be selected and is skipped.

- ▶ The LIMITS field is used to establish the minimum and maximum limits of the controlled spindle speed. When operating in the CSS or DIRECT RPM modes, the DAC output will not be set to a speed above or below these limits.

If the position display of the third axis is configured to be used for the spindle speed, the rpm in the SETTING field can be set to the current spindle speed by pressing the TEACH soft key.

Press ENTER to save the parameters and exit the input form. Press the C key to exit without saving the changes you made.

The settings will be lost when the ND 780 is switched off.

D:0   T:1   F: 0   0:00   MM																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="text-align: center;"><b>CSS/DIRECT RPM</b></td></tr> <tr><td colspan="2" style="text-align: center;">SETTING</td></tr> <tr><td colspan="2" style="text-align: center;">100 M/MIN</td></tr> <tr><td colspan="2" style="text-align: center;">GEAR SELECTION</td></tr> <tr><td colspan="2" style="text-align: center;">2</td></tr> <tr><td colspan="2" style="text-align: center;">LIMITS</td></tr> <tr><td>MIN</td><td style="text-align: center;">100 RPM</td></tr> <tr><td>MAX</td><td style="text-align: center;">1000 RPM</td></tr> </table>	<b>CSS/DIRECT RPM</b>		SETTING		100 M/MIN		GEAR SELECTION		2		LIMITS		MIN	100 RPM	MAX	1000 RPM	Enter the desired surface speed.
<b>CSS/DIRECT RPM</b>																	
SETTING																	
100 M/MIN																	
GEAR SELECTION																	
2																	
LIMITS																	
MIN	100 RPM																
MAX	1000 RPM																
OPERATION [CSS]	NOTE      HELP																

Fig. I.8 Form in which the speed limits are defined



## Activating the DAC output

After selecting the operating mode and entering its parameters, the DAC output must be enabled to begin controlling the spindle.

The output to the spindle inverter drive is an open loop signal. The system does not monitor the actual spindle speed. The output signal is based solely on the inverter's speed input versus the input voltage profile.

- ▶ Depending on the operating mode selected, the RPM or CSS soft key is displayed on the fourth page of the soft key menu. If the current state indicated on the soft key is ON, the DAC output is active. Press the soft key to OFF to disable the spindle control.

If CSS is active, the CSS icon appears next to the X-axis display. If the entered surface speed or rpm cannot be maintained because the speed is outside the range for the current gear or outside the limits from the CSS/RPM SETTINGS form, an arrow will appear after the CSS icon (**CSS↑** or **CSS↓**). The direction of the arrow indicates whether the speed is at the upper or lower limit.



The soft key to enable CSS or RPM control will not appear if the operating mode is set to OFF.



If the CSS control parameter under INSTALLATION SETUP is set to EXTERNAL, the CSS or RPM operation cannot be controlled by soft key. The soft key will show the current state, but pressing it will have no effect.

- ▶ The SPEED + and SPEED – soft keys are used to increase or decrease the current surface speed or spindle speed. The value is increased or decreased by 5% each time the soft key is pressed.



## Connecting the IOB to the inverter of the lathe

TURNING APPLICATION 1—Automatic CSS/Pot Control

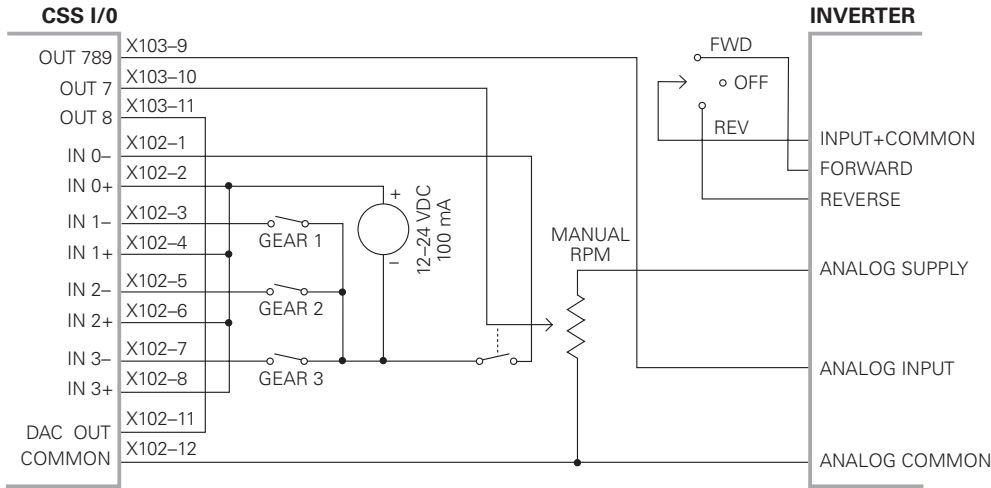


Fig. I.9 Example of gear detection and switching to manual spindle speed control

TURNING APPLICATION 2—Manual CSS/Pot Control

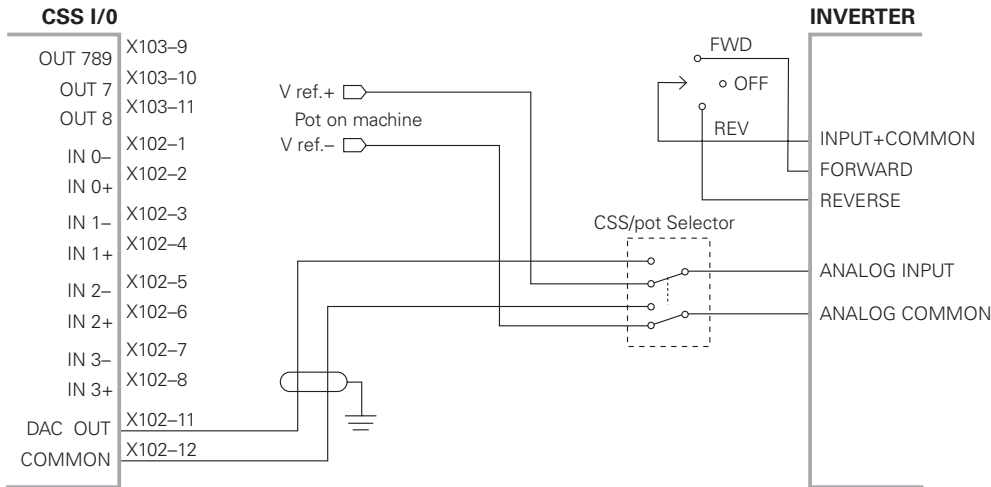


Fig. I.10 Example of switching to manual spindle speed control



## I – 3 Diagnostics

When the IOB 49 is connected to the ND 780, the DIAGNOSTICS menu under INSTALLATION SETUP provides further diagnostic possibilities. The information available varies depending on the configuration of the system (CSS or switching I/O functions).

### Switching I/O functions

The SWITCHING I/O DIAGNOSTICS shows the status of the communication via the CAN bus and the state of the switching inputs and outputs to provide monitoring of the switching functions.

- The CAN STATUS field shows the state of the bus communication between the position display unit and the IOB 49.

The status information has the following meaning:

Information	Meaning
NOT PRESENT	No communication with hardware
NOR	Communication – normal operation
CAL	Communication – Hardware in calibration mode
Wen	Watchdog active
Wds	Watchdog inactive
Wto	Watchdog time-out
Tx	Data is transmitted to hardware
Rx	Data is received by hardware

- The SWITCHING I/O field shows the state of the inputs and the switch position of the relays.

All currently active inputs (1 to 3) are shown in the ON field.

All currently active relay outputs (1 to 9) are shown in the OFF field.

The CALIBRATE soft key is used to re-synchronize the communication with the IOB 49. This, however, is only required if the module is not detected upon power on.



## CSS

CSS DIAGNOSTICS shows the status of the communication via the CAN bus and the state of the DAC output to provide monitoring of the interfaces for operation with constant surface speed. The state of the switching inputs and outputs is also shown.

- ▶ The CAN STATUS field shows the state of the bus communication between the position display unit and the IOB 49.

The status information has the following meaning:

Information	Meaning
NOT PRESENT	No communication with hardware
NOR	Communication – normal operation
CAL	Communication – Hardware in calibration mode
Wen	Watchdog active
Wds	Watchdog inactive
Wto	Watchdog time-out
Tx	Data is transmitted to hardware
Rx	Data is received by hardware

- ▶ The DAC OUTPUT field shows the current value of the transmitted voltage. The value is between 0 and 4095, which corresponds to a voltage of 0 to 10 V at X102-11. The corresponding CSS icon will be displayed if the spindle speed is at the upper or lower limit (**CSS↑** or **CSS↓**).
- ▶ The CSS INPUT/OUTPUT field shows the state of the switching inputs and relay outputs.





The status information has the following meaning:

Information about the inputs	Meaning
EXT	External switch is active (X102-12)
G1	Switch for gear 1 is active (X102-3,4)
G2	Switch for gear 2 is active (X102-5,6)
G3	Switch for gear 3 is active (X102-7,8)

Information about the outputs	Meaning
POT	Potentiometer relay is active (X103-10)
DAC	DAC output relay is active (X102-11)

The CALIBRATE soft key is used to re-synchronize the communication with the IOB 49. This, however, is only required if the module was not detected at switch-on.





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