



DOCUMENTATION ISG-kernel

Functional description Jog of path

Short Description:
FCT-C15

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Preface

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or (EN)

<https://www.isg-stuttgart.de/en/products/softwareproducts/isg-kernel/documents-and-downloads>

contains further information on messages generated in the NC kernel, online help, PLC libraries, tools, etc. in addition to the current documentation.

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Icons used and their meanings

This documentation uses the following icons next to the safety instruction and the associated text. Please read the (safety) instructions carefully and comply with them at all times.

Icons in explanatory text

➤ Indicates an action.

⇒ Indicates an action statement.



⚠ DANGER

Acute danger to life!

If you fail to comply with the safety instruction next to this icon, there is immediate danger to human life and health.



⚠ CAUTION

Personal injury and damage to machines!

If you fail to comply with the safety instruction next to this icon, it may result in personal injury or damage to machines.



Attention

Restriction or error

This icon describes restrictions or warns of errors.



Notice

Tips and other notes

This icon indicates information to assist in general understanding or to provide additional information.



Example

General example

Example that clarifies the text.



Programing Example

NC programming example

Programming example (complete NC program or program sequence) of the described function or NC command.



Release Note

Specific version information

Optional or restricted function. The availability of this function depends on the configuration and the scope of the version.

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1 Overview

Task

This function permits a pause in the machining process to be made in a channel and to move the same physical axes from a second channel.

This is referred to as a channel switchover.

Properties

Switching over a channel to react to events which require any path motion, e.g. changing a torch in a flame or gas cutting operation.

Parameter

An auxiliary channel is required here; it must contain the parameters [▶ 8] for the auxiliary axes.

Mandatory note on references to other documents

For the sake of clarity, links to other documents and parameters are abbreviated, e.g. [PROG] for the Programming Manual or P-AXIS-00001 for an axis parameter.

For technical reasons, these links only function in the Online Help (HTML5, CHM) but not in pdf files since pdfs do not support cross-linking.

2 Description

Request

The user has the frequent request to interrupt a running program in order to insert a path motion and then continue the program after the interruption.

Inserting a path motion can be implemented by using an “auxiliary channel”. In this document, the “auxiliary channel” is referred to as the **jog-of-path channel**.

The **jog-of-path channel** contains linked axes that are linked to the identical physical axes, e.g. the axes of the actual channel.

Switchover

Channels are switched over by the PLC. Exclusive access of a channel to physical axes is controlled by a control unit provided for each channel.

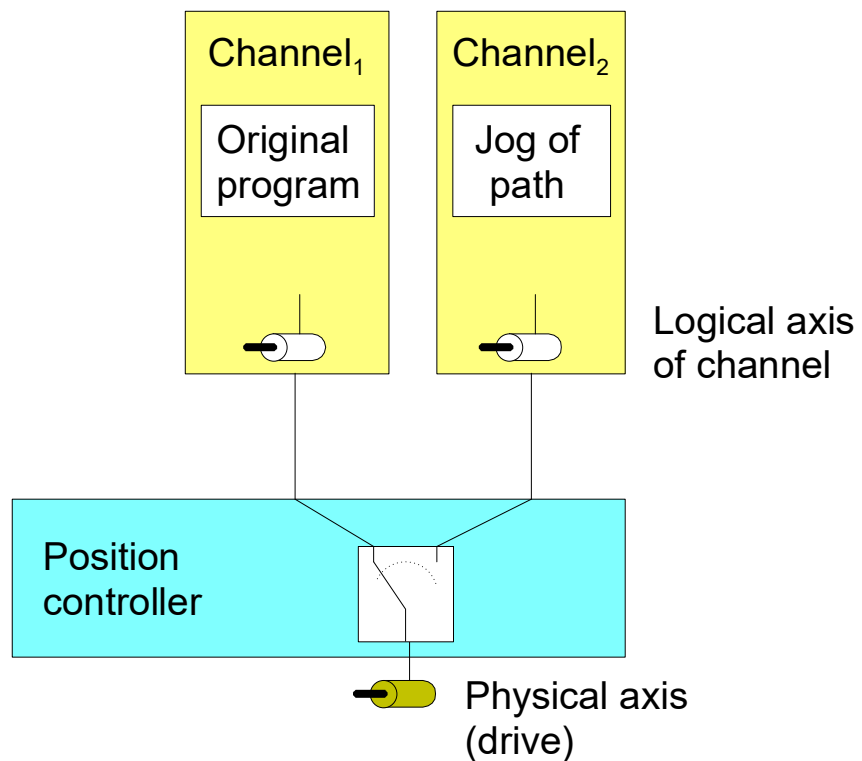


Fig. 1: Moving axes by different channels

Position offset

When an axis is moved by an inserted path motion, it also retains the offset in the original channel as soon as this channel regains access to the axis.

If this is not required, the user must ensure that the axes are returned to the position they were in before the interruption.



Notice

Licensing note

No additional channel license is required for jog of path channels containing only axes which are linked to physical axes of other channels.



Notice

Suspending axes is not possible when a channel is in an error state, for example, due to a programming error or when a channel axis error.

Before suspending the channel axes, remove the error state and reset the channel.

2.1 Configuring axes and channels

Axes

In order to interrupt a machining process and move an axis through a different channel, an additional logical axis (e.g. Log. AxisNo. 11) is configured and linked to an existing physical axis (e.g. Log. AxisNo. 1). The link is specified in the axis parameter `kopf.link_to` (P-AXIS-00101).

A clone operation takes over all data from the original axis except for the new axis number. This is executed by the axis parameter `kopf.clone_of` (P-AXIS-00040) by specifying the axis number of the axis whose axis parameter list is to be copied.

```
kopf.achs_nr           11
kopf.link_to           1
kopf.clone_of          1
```

Channels

The channels are configured with the logical axes as usual.

Channel 1 contains axes 1 to 3 as the main axes

```
gruppe[0].achs_anzahl      3
gruppe[0].achse[0].log_achs_nr  1
gruppe[0].achse[0].bezeichnung  X
gruppe[0].achse[1].log_achs_nr  2
gruppe[0].achse[1].bezeichnung  Y
gruppe[0].achse[2].log_achs_nr  3
gruppe[0].achse[2].bezeichnung  Z
```

Channel 2 represents the auxiliary channel and contains axes 11 to 13 as main axes

```
gruppe[0].achs_anzahl      3
gruppe[0].achse[0].log_achs_nr  11
gruppe[0].achse[0].bezeichnung  X
gruppe[0].achse[1].log_achs_nr  12
gruppe[0].achse[1].bezeichnung  Y
gruppe[0].achse[2].log_achs_nr  13
gruppe[0].achse[2].bezeichnung  Z
```

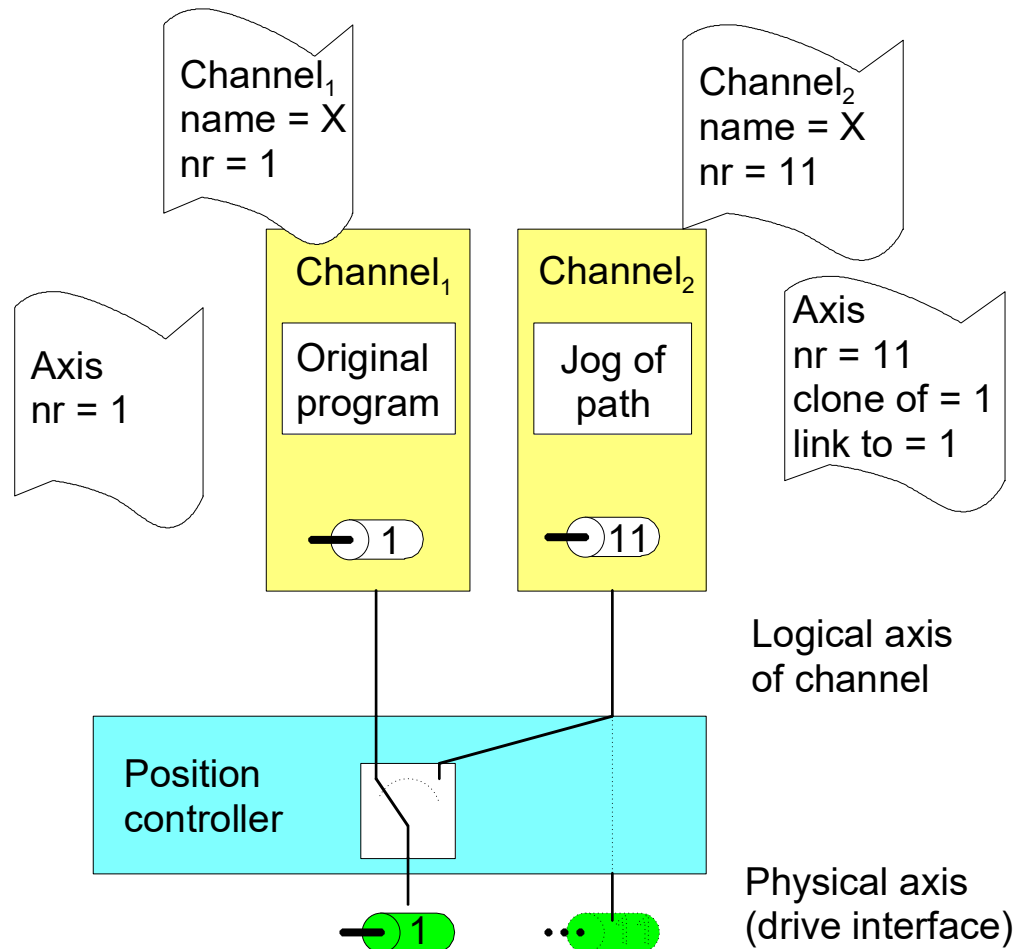



Fig. 2: Configuring axes

Cloned axis

To create a cloned axis, the axis must first already exist and be initialised before its axis parameter list can be used as a template for the cloned axis. A cloning process involves taking over the parameters of the axis which acts as a template only once. Any subsequent change in axis parameters has no effect on the cloned data set. It only modifies or overwrites the individual axis parameters.

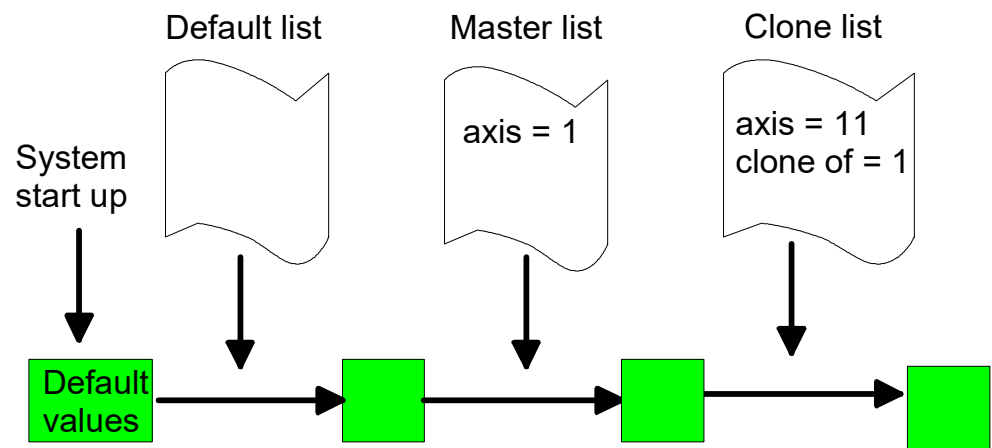


Fig. 3: Initialising a cloned axis



Notice

The specified clone reference cannot be changed after the first initialisation.



Notice

If there is no master axis of the clone, the error messages P-ERR-70172 and P-ERR-50462 are issued and a cloned axis is created without a real cloning process.

2.2 Switchover sequence

Access to axes

As long as the output of a channel is not suspended, the physical axes are linked to the logical axes of the channel. If a second channel requests the same physical axes as those of the first channel, the system waits automatically until the first channel has suspended its output.

If axes move in the channel which suspends axis access, these axes are stopped by a feedhold triggered internally in the NC kernel.

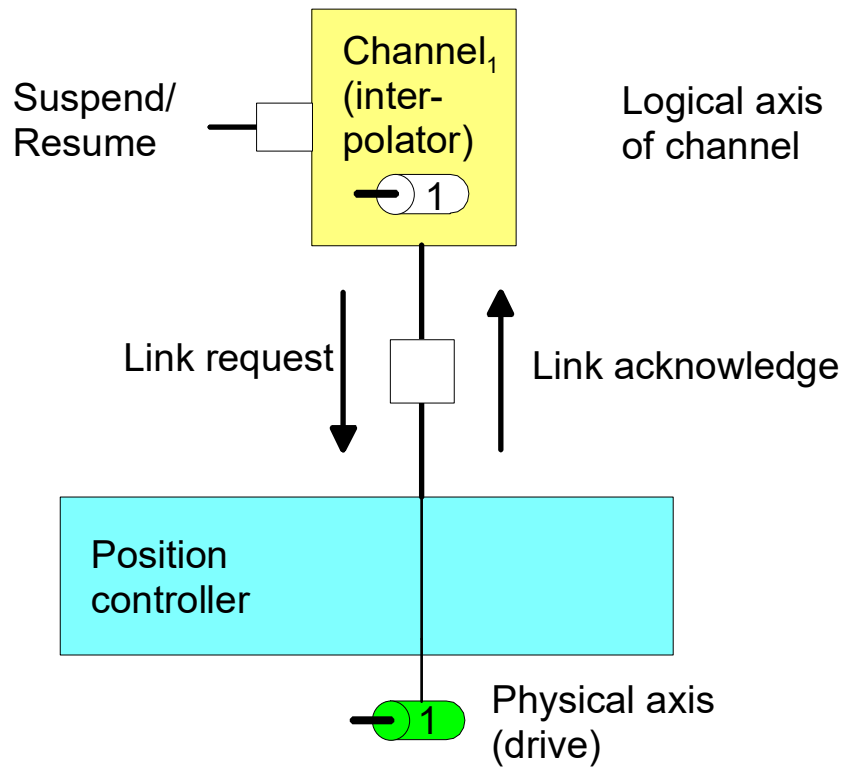


Fig. 4: Handshake between axes when access to a channel axis is suspended



Notice

If access to a physical axis is configured by two (or several) channels, one channel is not given access to the axes until all other channels have suspended their access.

2.3 Positions off set

The link between a physical and a logical axis can be changed by an active program with the axes at standstill. After axis output is suspended, the axes can be moved by another channel.

After an axis is returned to the original channel, the commanded position in the channel (command position) and the physical position (active position) may be different. This position offset is cleared at program start and with NC commands (such as #CHANNEL INIT[], deselection of G200 etc.) which cause a position adjustment in the channel.

Therefore, the commanded position in the channel corresponds to the physical set position of the axis (command position = active position).



Notice

The position offsets of the axes are cleared when the channel is initialised or at program start.

Offset = command position (of active link) – active position

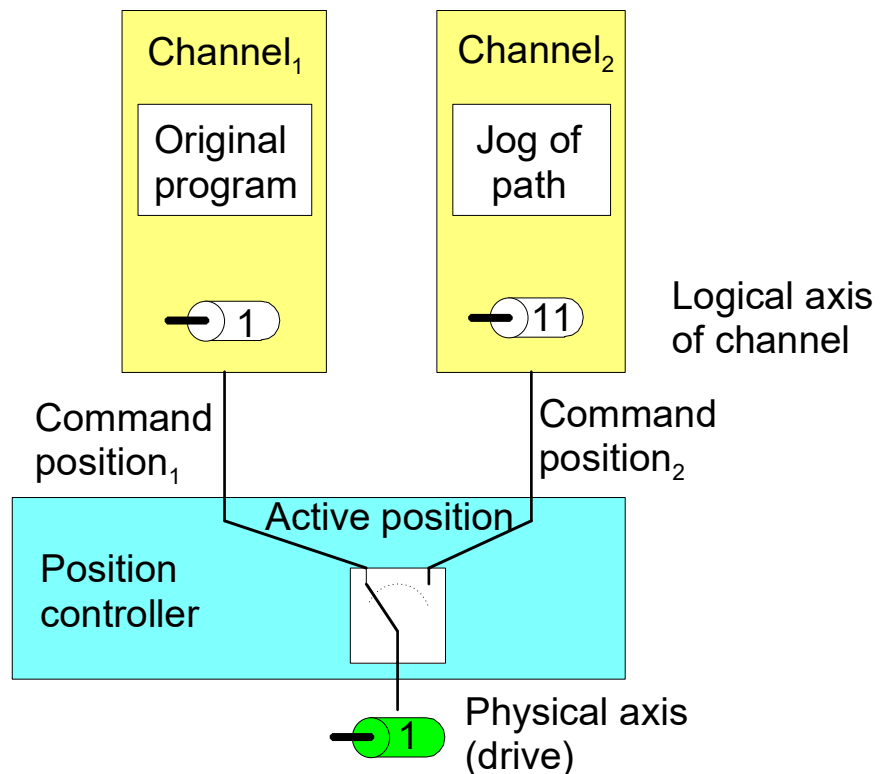


Fig. 5: Position offset by another channel



Example

Manual block in both channels

Axis 1 of channel 1 and axis 11 of channel 2 are linked to the same physical axis. In each channel, a different manual block (without M30) is started and the channels are suspended one after another.

Channel 1: Command position (command position)	Channel 2: Command position (command position)	Physical axis position (active position)	Offset Channel 1	Offset Channel 2
0 -> 50		0 -> 50	0	0
	50 -> 15	50 -> 15	0	0
50 -> 80		15 -> 45	35	-30
	15 -> 0	45 -> 30	50	-30

2.4 Application examples

configuration

2 channels are configured. In channel 1, the Y axis is configured with log axis no. 2 and in channel 2, the cloned axis is configured with the log. axis no. 11.

Configuration of an additional logical axis 11 for physical axis number 2

```

kopf.achs_nr           11
kopf.link_to           2
kopf.clone_of          2
  
```

Actions

1. Start manual block "G01 G90 X20 Y20 F100" in 1.Kanal 1
2. Set "Suspend-Output" in the channel 1 to 1
3. Clear "Suspend-Output" in the other channel 2
4. Start manual block "G91 Y10" in channel 2 and wait until it ends its execution
5. Clear "Suspend-Output" in channel 1
6. Set "Suspend-Output" in channel 2

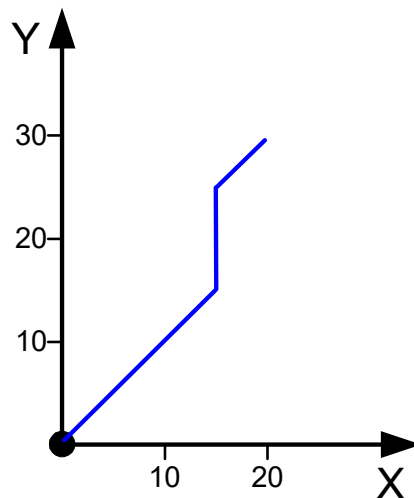


Fig. 6: Position sequence of the example

Alternatively, a motion can be started in manual mode in channel 2 instead of the manual block.

3 PLC interface

The PLC interface provides control units to switch channel access to the axes and to display the axes.

Interrupt output of command values to real axes	
Description	<p>This interrupts the output of NC channel command values to physical axes. The NC channel is stopped and assignment to the real axes is disabled.</p> <p>Physical axes can then be requested and moved by another channel. A different logical axis can be linked to a physical axis here.</p> <p>After clearing this interruption, the axes can be requested again and the original channel continues its motion.</p>
Data type	MC_CONTROL_BOOL_UNIT, see description Control Unit
Access	PLC reads request_r + state_r and writes command_w + enable_w
ST path	gpCh[channel_idx]^bahn_mc_control.suspend_axis_output
Commanded, requested and return value	
ST element	.command_w .request_r .state_r
Data type	BOOL
Value range	[TRUE, FALSE]
Redirection	
ST element	.enable_w
Positions off set	
Description	<p>Display of the current offset of the absolute position between the position controller axis (real physical axis) and the interpolator axis (logical axis) currently linked in the axis coordinate system.</p> <p>An offset between the interpolator position and the position controller position caused by the use of functions such as "jog of path" (see [FCT-C15] is displayed here.</p> <p>The offset displayed contains no offsets caused by zero offsets, for example.</p>
Signal flow	CNC → PLC
ST path	gpAx[axis_idx]^lr_state.position_offset_r
Data type	DINT
Unit	0,1 µm
Access	PLC reads

Axis supply	
Description	The command of the physical axes is executed by the logical axis specified in the NC channel.
Signal flow	CNC → PLC
ST path	gpAx[axis_idx]^lr_state.link_to_ipo_r
Data type	UINT
Value range	[= 0 – not linked, > 0 – logic axis number]
Access	PLC reads

Axis assignment	
Description	The display shows the physical axes to which the commanded values of the logical axes are of the channel output.
Signal flow	CNC → PLC
ST path	gpAx[axis_idx]^ipo_state.link_to_lr
Data type	UINT
Value range	[= 0 – not linked, > 0 – logic axis number]
Access	PLC reads

3.1 PLC example code for CNC Builds as of V2.11.20xx

Interrupt output of command values to real axes	
Description	<p>This interrupts the output of NC channel command values to physical axes. The NC channel is stopped and assignment to the real axes is disabled.</p> <p>Physical axes can then be requested and moved by another channel. A different logical axis can be linked to a physical axis here.</p> <p>After clearing this interruption, the axes can be requested again and the original channel continues its motion.</p>
Data type	MCCControlDistCtrlUnit, see description of Control Unit
Access	PLC reads Request + State and writes Command + Enable
ST path	pMC[channel_idx]^addr^.MCCControlBahn_Data.MCCControlBoolUnit_SuspendAxisOutput
Commanded, requested and return value	
ST element	.X_Command .X_Request .X_State
Data type	BOOL
Value range	[TRUE, FALSE]
Redirection	
ST element	.X_Enable

Positions off set	
Description	<p>Display of the current offset of the absolute position between the position controller axis (real physical axis) and the interpolator axis (logical axis) currently linked in the axis coordinate system.</p> <p>An offset between the position controller position and the interpolator position caused by the use of functions such as “jog of path” (see [FCT-C15 [▶ 6]]) is displayed here.</p> <p>The offset displayed contains no offsets caused by zero offsets, for example.</p>
Signal flow	CNC → PLC
ST path	pAC[axis_idx]^ .addr^ .StateLR_Data.D_PositionOffsetPhysicalLogicalACS
Data type	DINT
Value range	0,1 µm
Access	PLC reads

Axis supply	
Description	The command of the physical axes is executed by the logical axis specified in the NC channel.
Signal flow	CNC → PLC
ST path	pAC[axis_idx]^ .addr^ .StateLR_Data.W_LinkToLogicalAxis
Data type	UINT
Value range	[= 0 – not linked, > 0 – logic axis number]
Access	PLC reads

Axis assignment	
Description	The display shows the physical axes to which the commanded values of the logical axes are of the channel output.
Signal flow	CNC → PLC
ST path	pAC[axis_idx]^ .addr^ .StateIPO_Data.X_LinkToPhysicalAxis
Data type	UINT
Value range	[= 0 – not linked, > 0 – logic axis number]
Access	PLC reads

4 HMI interface

The current state of an axis can be read by the following channel-specific CNC objects of the axis.

- requested_link_to_physical_axis [▶ 21]
- actual_link_to_physical_axis [▶ 21]
- link_state [▶ 22]

In the example below, channel 1 is waiting for the acknowledgement of the request for the second axis. This can be seen by the CNC object “link_state” which has the value 2.

The command value suppression is not active in either channel.

The screenshot shows the ISG Object Browser interface. On the left, a tree view shows 'Channel 1' expanded to 'Axis 2'. The main window displays a table of CNC objects for Channel 1. The 'link_state' object (No. 25) is highlighted in blue, showing a value of 2. To the right, a 'Status pane' shows a table of source objects, including 'suspend_axis_ou...' with a value of 0.

No	Group	Offset	Name	Value	Unity
21	0x21301	0x20014	ramp time: dec--	30000	µs
22	0x21301	0x20015	rel_solllw_real64	0	0.1 µm/ta
23	0x21301	0x20016	requested_link_to_physical_axis	2	-
24	0x21301	0x20017	actual_link_to_physical_axis	0	-
25	0x21301	0x20018	link_state	2	-
26	0x21301	0x20019	manual cmd. abs. limit	-500	0.1 µm

Source	Name	Value	Group
GEO > Channels ...	suspend_axis_ou...	0	0x21301
GEO > Channels ...	suspend_axis_ou...	0	0x21302

Fig. 7: Waiting for axis acknowledgement.

5 Parameter

5.1 Overview

ID	Parameter	Meaning
P-AXIS-00040	kopf.clone_of	Axis copy
P-AXIS-00101	kopf.link_to	Link to the physical axis
P-AXIS-00483	kenngr.auto_release_of_axis_link	Enabling of IPO-LR interface after axis release
P-CHAN-00306	jog_of_path_only	License check of the clone channel

5.2 Description

Channel parameters

P-CHAN-00306	Checking the license in the clone channel
Description	This parameter checks the license in the clone channel. When this parameter is set, a check is made during start-up whether all the axes configured in the channel are clone axes. Only then is this channel license-free. The check is also made at RESET and axis exchange. If an axis is not a clone axis, an error message is output.
Parameter	jog_of_path_only
Data type	BOOLEAN
Data range	0/1
Dimension	----
Default value	0
Remarks	This parameter allows the 2nd channel to be used as a Jog-Of-Path channel even with a single-channel license. The parameter is available as of Build V3.1.3037.17.

Axis parameter

P-AXIS-00040	Mapping of parameters of an existing axis for default configuration.	
Description	For easier configuration, an axis could be a copy (clone) of another axis. This means, when the axis is initialised, the clone just uses the data of its master as template. The clone merely has to specify the differences to its master in the parameter list.	
Parameter	kopf.clone_of	
Data type	UNS16	
Data range	0 < clone_of < MAX(UNS16)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Drive types	----	
Remarks		
P-AXIS-00101	Linking an interpolator output to a specific physical axis.	
Description	The parameter requests a link between the logical axis of the interpolator and the axis of the position controller (drive). If you attempt to link more than one logical axis to the same drive, the other axes must wait until this link is temporarily interrupted by a command and released for a new connection.	
Parameter	kopf.link_to	
Data type	UNS16	
Data range	0 < link_to < MAX(UNS16)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Drive types	----	
Remarks		

P-AXIS-00483	Enabling of IPO-LR interface after axis release	
Description	<p>A drive can be connected with more than one axis as part of the functionality 'Jog of Path' (link_to, P-AXIS-00101). Here the drive is supplied via the axis-specific interface between interpolator and position controller (see [FCT-C15 [▶ 6]]).</p> <p>If this type of linked axis leaves the interpolator after an axis release, and a SUSPEND command is executed in this channel, the interface is not enabled. Another channel that possibly requests this axis has no access to this interface and stops.</p> <p>By setting the parameter 'kenngr.auto_release_of_axis_link' this interface is automatically enabled when the axis is released and a system stop can be avoided.</p>	
Parameter	kenngr.auto_release_of_axis_link	
Data type	BOOLEAN	
Data range	0/1	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Drive types	----	
Remarks		

5.3 CNC objects

Name	requested_link_to_physical_axis		
Description	This object shows the number of the requested physical axis. (used for channel switchover)		
Task			
Index group	0x12130<C _{ID} >	Index offset	0x<A _{ID} >0016
Data type	UNS16	Length	2
Attributes		Unit	
Remarks			

Name	actual_link_to_physical_axis		
Description	This object shows the currently assigned physical axis. (used for channel switchover)		
Task			
Index group	0x12130<C _{ID} >	Index offset	0x<A _{ID} >0017
Data type	UNS16	Length	2
Attributes		Unit	
Remarks			

Name	link_state		
Description	This object shows the state of the axis request, i.e. the assignment of logical and physical axes: 0 : Axis link already existing 1 : Physical axis is requested by the position controller 2 : Waiting for acknowledgement of the physical axis from the position controller (used for channel switchover)		
Task			
Index group	0x12130<C _{ID} >	Index offset	0x<A _{ID} >0018
Data type	UNS32	Length	4
Attributes		Unit	
Remarks			

Keyword index

A

Achse

Achsversorgung

Versorgung:physikalische durch logischen Achse	16
Zuordnung:logisch	17
Zuordnung:logisch/physikalisch	16
physikalische Achse zur logischen Achse	17

L

Link

zu logischer Achse	16
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P

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P-AXIS-00101	20
P-AXIS-00483	21
P-CHAN-00306	19

pAC

Position

X_LinkToLogicalAxis	17
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S

Sollwertausgabe auf reale Achsen

unterbrechen	15, 16
--------------------	--------

V

Verbindung

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Z

Zuordnung

Zuordnuung

Achse:logisch/physikalisch	16
Achse:logisch	17

6 Appendix

6.1 Suggestions, corrections and the latest documentation

Did you find any errors? Do you have any suggestions or constructive criticism? Then please contact us at documentation@isg-stuttgart.de. The latest documentation is posted in our Online Help (DE/EN):



QR code link: <https://www.isg-stuttgart.de/documentation-kernel/>

The link above forwards you to:

<https://www.isg-stuttgart.de/fileadmin/kernel/kernel-html/index.html>



Notice

Change options for favourite links in your browser;

Technical changes to the website layout concerning folder paths or a change in the HTML framework and therefore the link structure cannot be excluded.

We recommend you to save the above "QR code link" as your primary favourite link.

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