



New multi-path BasePMC

Dual Check Safety

Series 30*i*/31*i*/32*i*-MODEL A

Series 30*i*/31*i*/32*i*/35*i*-MODEL B

Series 0*i*-MODEL D

Series 0*i*-MODEL F

Series Power Motion *i* MODEL A



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Introduction

The library NewMP_BasePMC-x.x.x allows an easy creation of a basic multi-path Dual Check Safety PMC. The manual NewMP_BasePMC_user_manual_en.pdf describes how to configure and create the MbasePMC.LAD and MbaseDCS.LAD project.

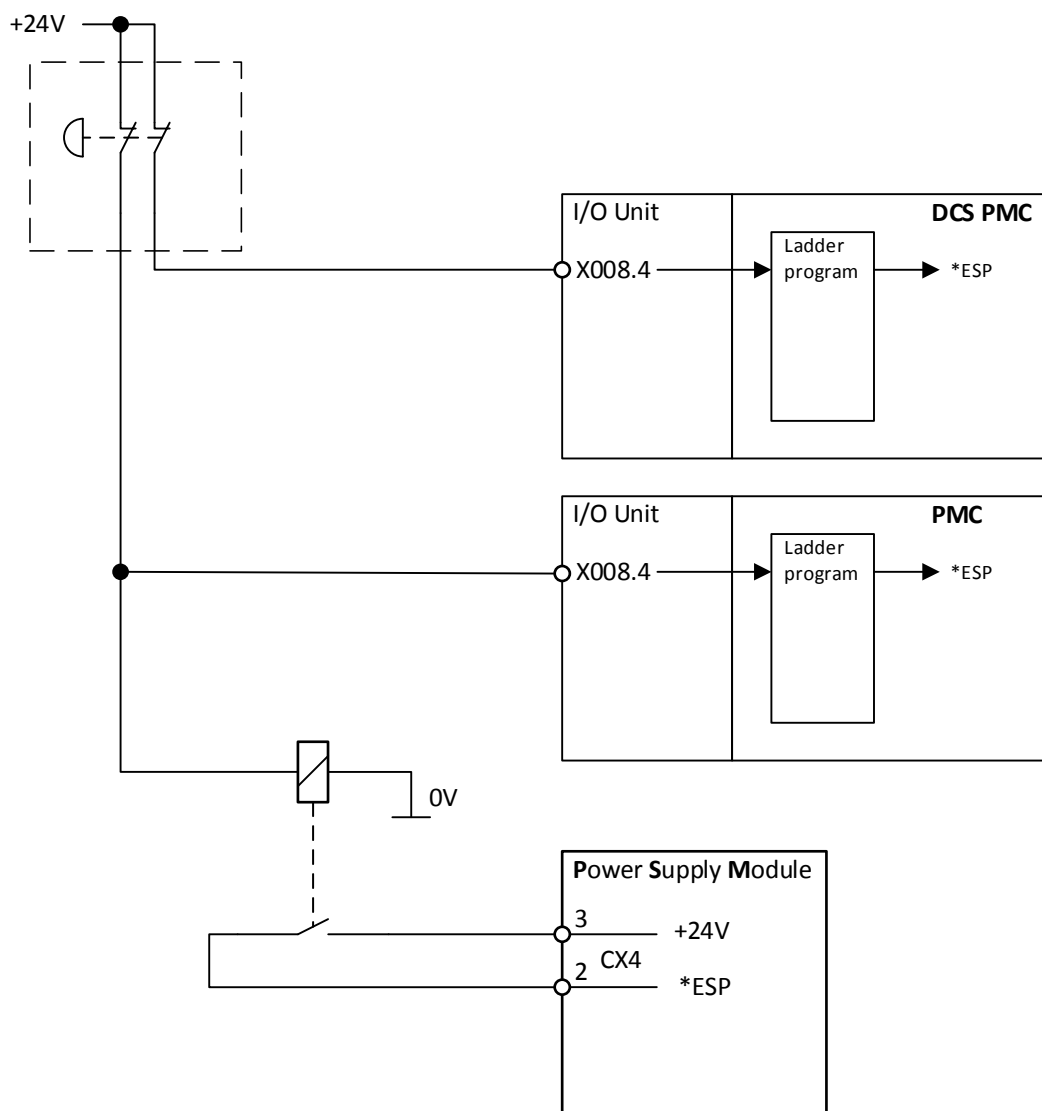
This manual describes the hardware configuration, functionality and parameter setting to get multi-path Dual check safety running.

Depending on the configuration, the following functionality will be included in the DCS related part of the PMC program:

- 1 safety zone
- 1 protection door
- Switch to activate set-up mode
- Hold-to-Run button
- 2 monitored speed sets (set1 = zero speed monitoring, set2 = moving at limited speed)
- External deceleration
- Limitation of spindle speed by PMC at open door
- MCC test
- Brake test

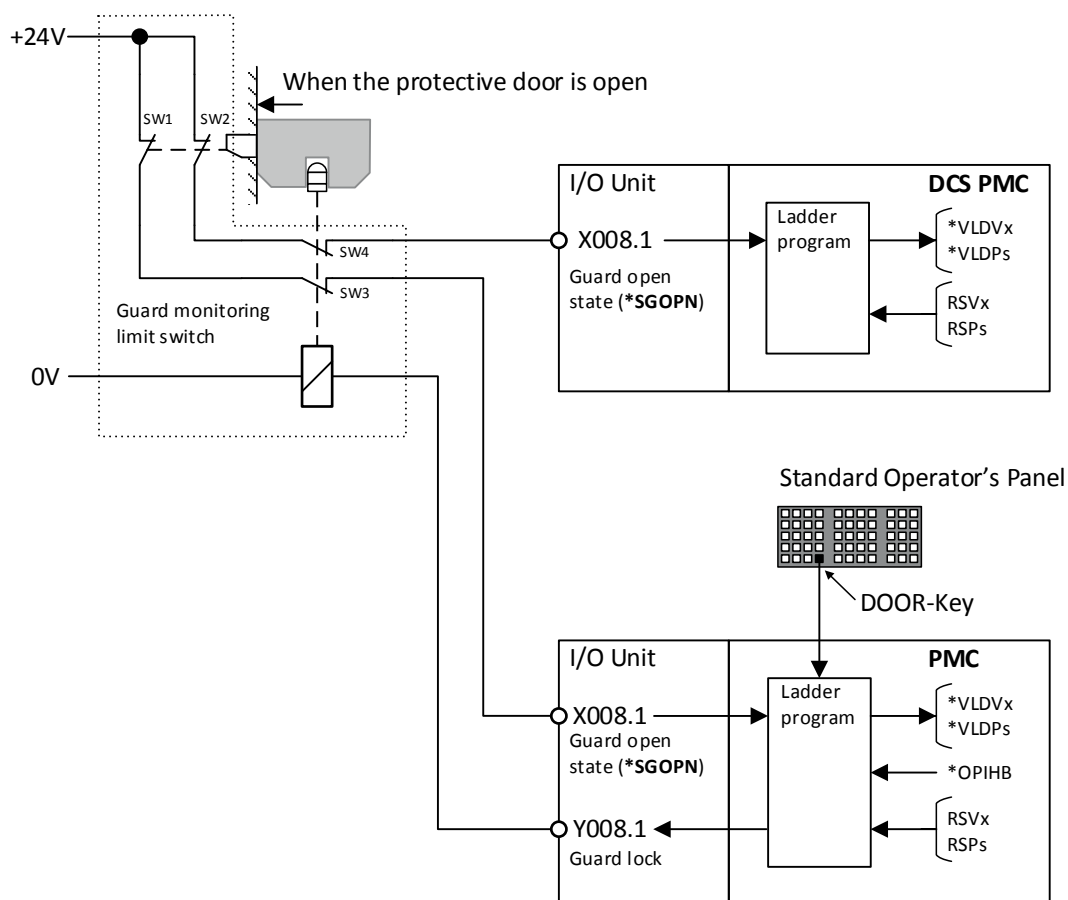
Hardware configuration

Emergency stop



Door locking

The door key is used to unlock the door. When the conditions for the door unlocking are satisfied, the door will be unlocked for about 5 seconds.

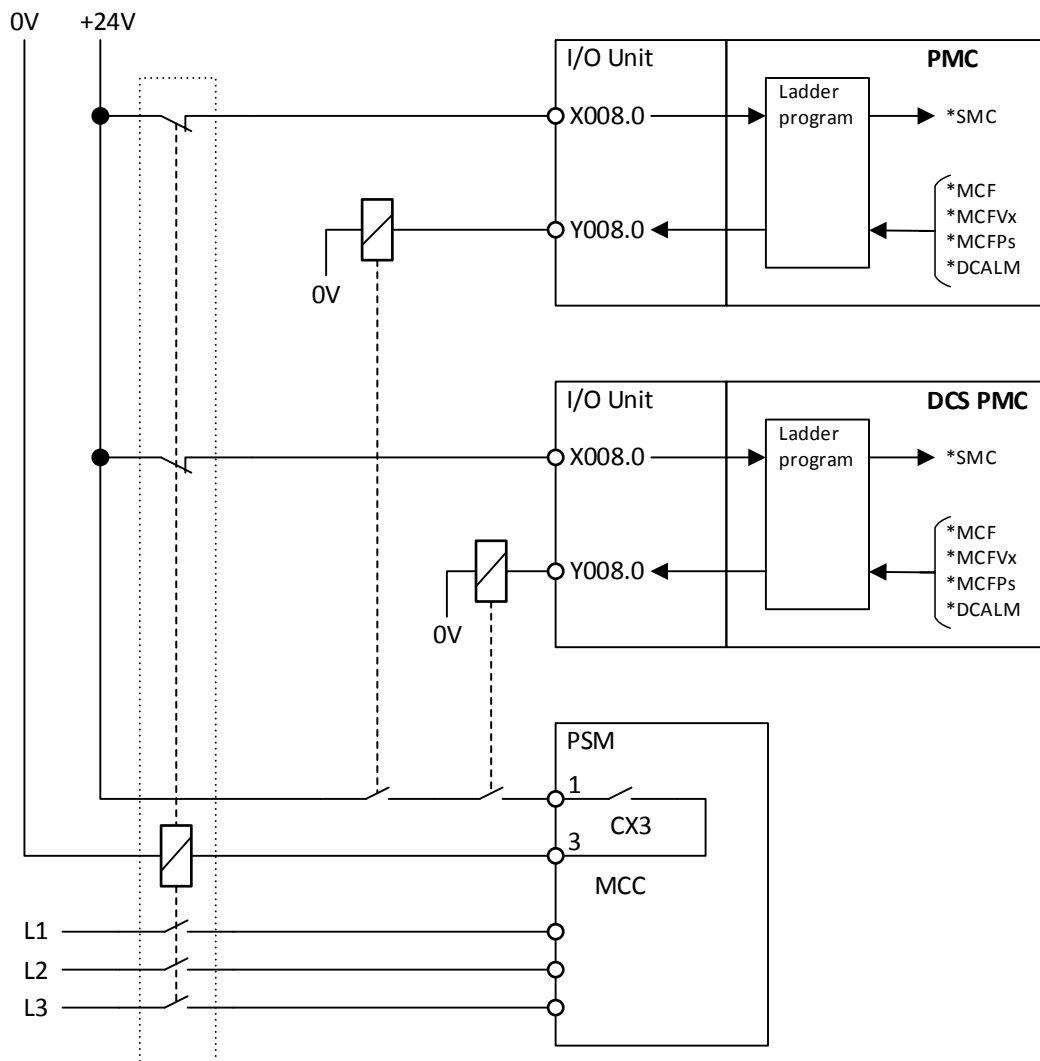


MCC

When a MCC test is required, the test will be started when the door key is pressed and the conditions for the MCC test are satisfied.

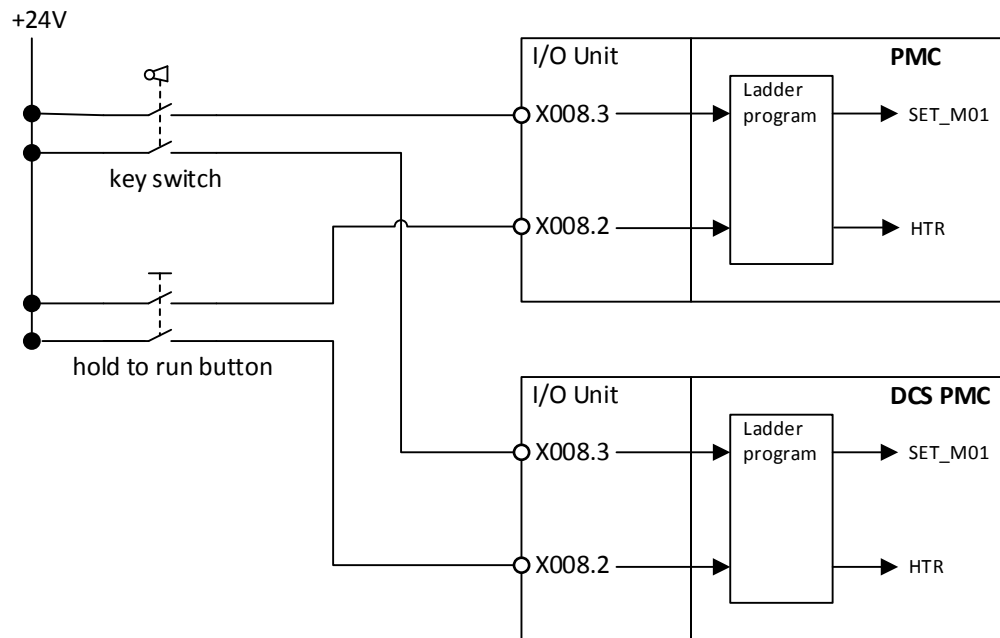


This functionality will be included in case of `mcc_test = 1` and `dcs_support = 1`



Set-up mode

In case of the key switch is in OFF condition, the zero speed is monitored (axes and spindle are interlocked).
In case of the key switch is in ON condition and the hold to run button is pressed, the axes can be moved and the spindle can be started at limited speed. Program start is not possible.

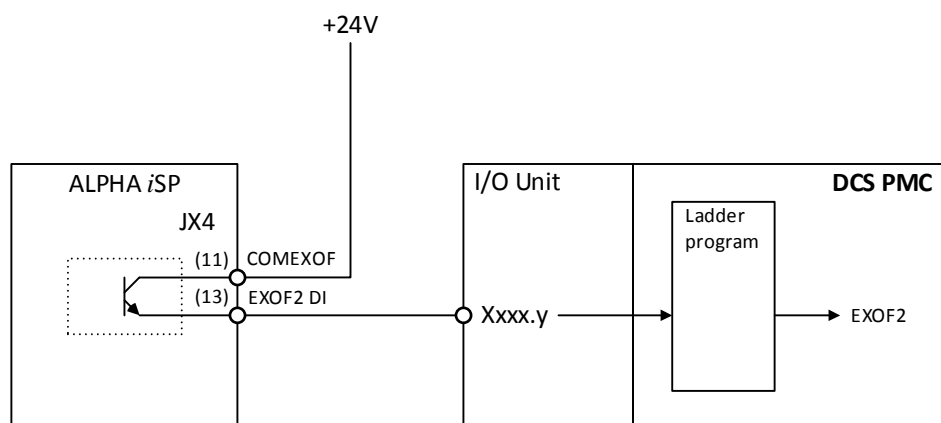


Safe spindle stop (serial spindle)

When the spindle is in excitation off state, the spindle monitoring is switched off to enable rotation by hand.




This functionality will be included in case of 0i-D and 3xi-A controls when spindle_support_Pxx = 1 and dcs_support = 1



Spindle safe torque off

The level-up α iSP-B series and β iSVSP-B series support a Safe Torque Off (STO) function that conforms to IEC 61800-5-2, which enables safe power cut-off for serial spindles. In some cases the power of the spindle must be cut-off for free rotation by hand e.g. for manual tool exchange during machining.

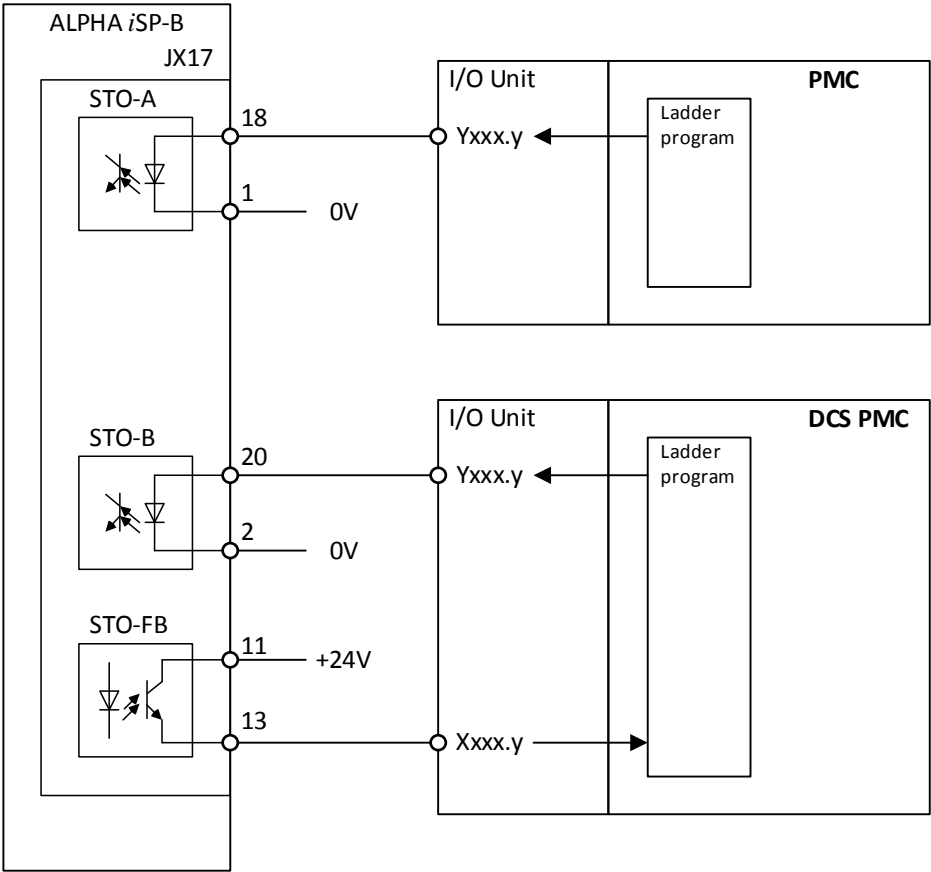


This functionality will be included in case of 3xi-B, 0i-F and PMi-A controls when spindle_support_Pxx = 1 and dcs_support = 1

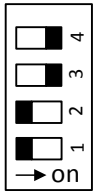
Level-up ALPHA iSP-B

For the description of the function, see B-65412EN chapter SAFE TORQUE OFF FUNCTION.

Connection:



Switch settings:

	AXIS	SWITCH NUMBER	STO SETTING
	M-axis	SW1-4	ON: Disabled
		SW1-3	ON: Disabled
	L-axis	SW1-2	ON: Disabled OFF: Enabled
		SW1-1	ON: Disabled OFF: Enabled

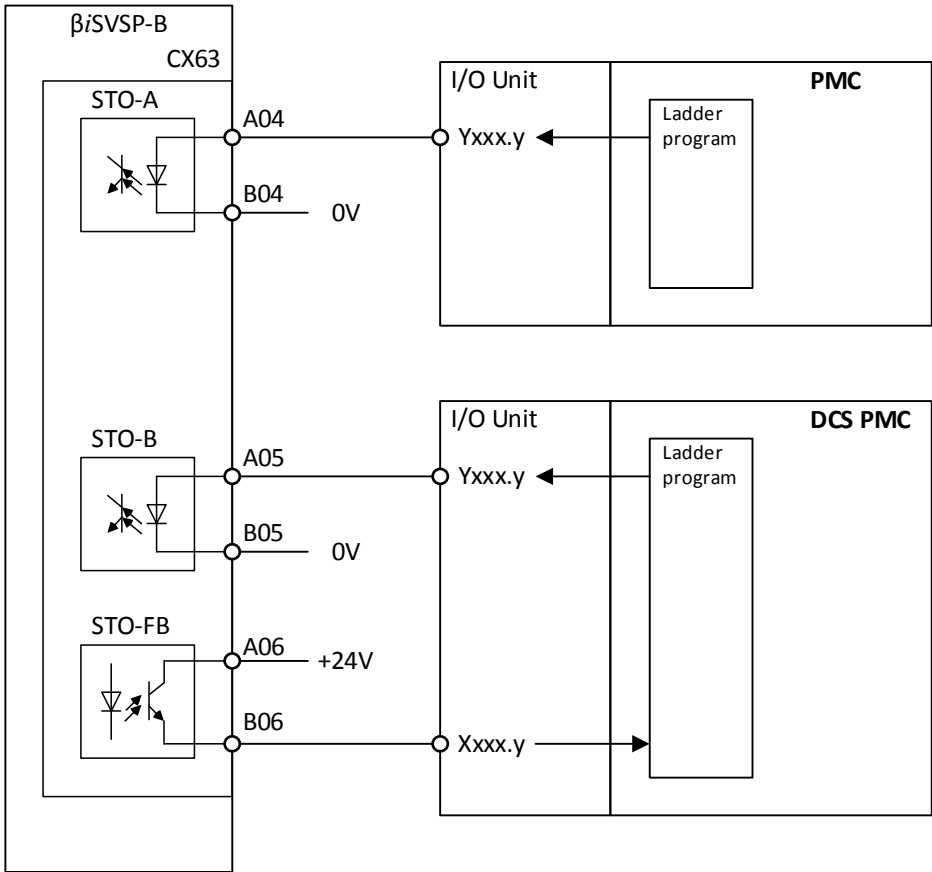
Parameter setting:

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
S	N04542#1	STO			0: Does not use the Safe Torque Off function. 1: Uses the Safe Torque Off function.

BETA iSVSP-B

For the description of the function, see B-65422EN chapter SAFE TORQUE OFF FUNCTION.

Connection:



Switch settings:

	AXIS	SWITCH NUMBER	STO SETTING
All servo axes	Spindle	SW1-4	
		SW1-3	
		SW1-2	ON: Disabled OFF: Enabled
		SW1-1	ON: Disabled OFF: Enabled

Parameter setting:

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
S	N04542#1	STO			0: Does not use the Safe Torque Off function. 1: Uses the Safe Torque Off function.

Axes safe torque off

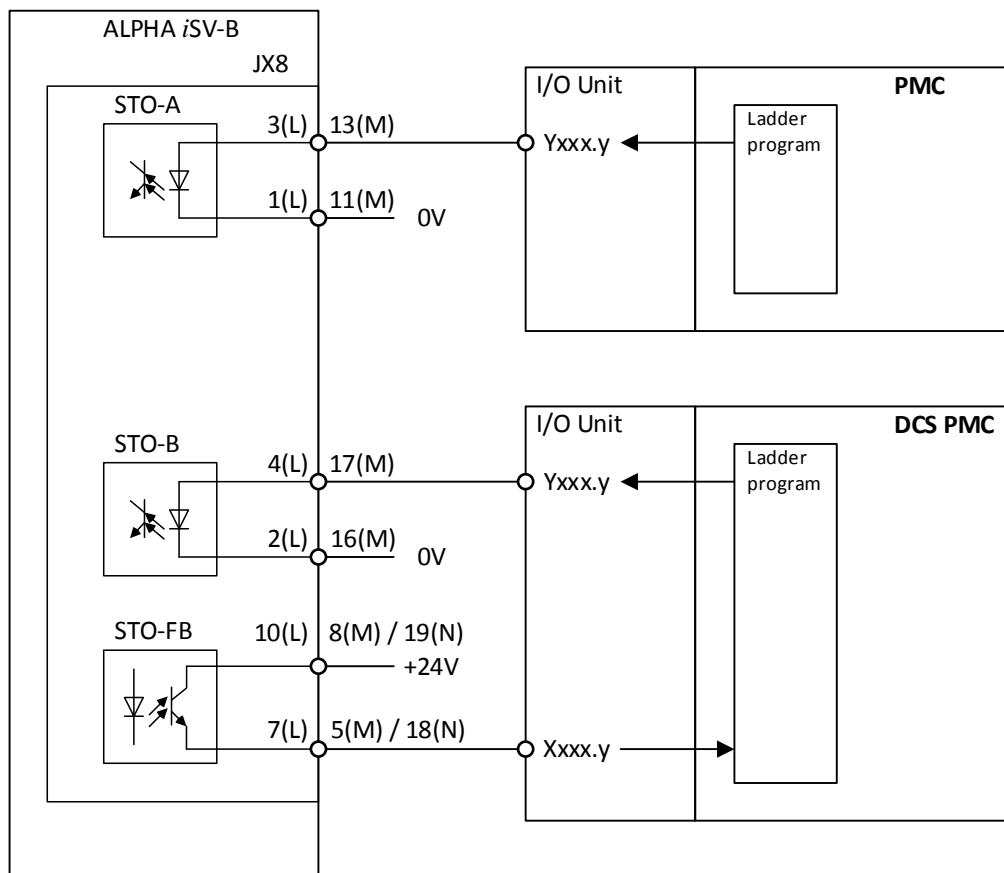
The α SV-B series and β SVSP-B series support a Safe Torque OFF (STO) function that conforms to IEC 61800-5-2, which enables safe power cut-off for servo axes.

In some cases the power of an axis must be cut-off for free rotation by hand e.g. manual work-piece exchange during machining.


ALPHA *i*SV-B

For the description of the function, see B-65412EN chapter SAFE TORQUE OFF FUNCTION.

Connection:



Switch settings:

	AXIS	SWITCH NUMBER	STO SETTING
	N-axis	SW1-6	ON: Disabled OFF: Enabled
		SW1-5	ON: Disabled OFF: Enabled
	M-axis	SW1-4	ON: Disabled OFF: Enabled
		SW1-3	ON: Disabled OFF: Enabled
	L-axis	SW1-2	ON: Disabled OFF: Enabled
		SW1-1	ON: Disabled OFF: Enabled

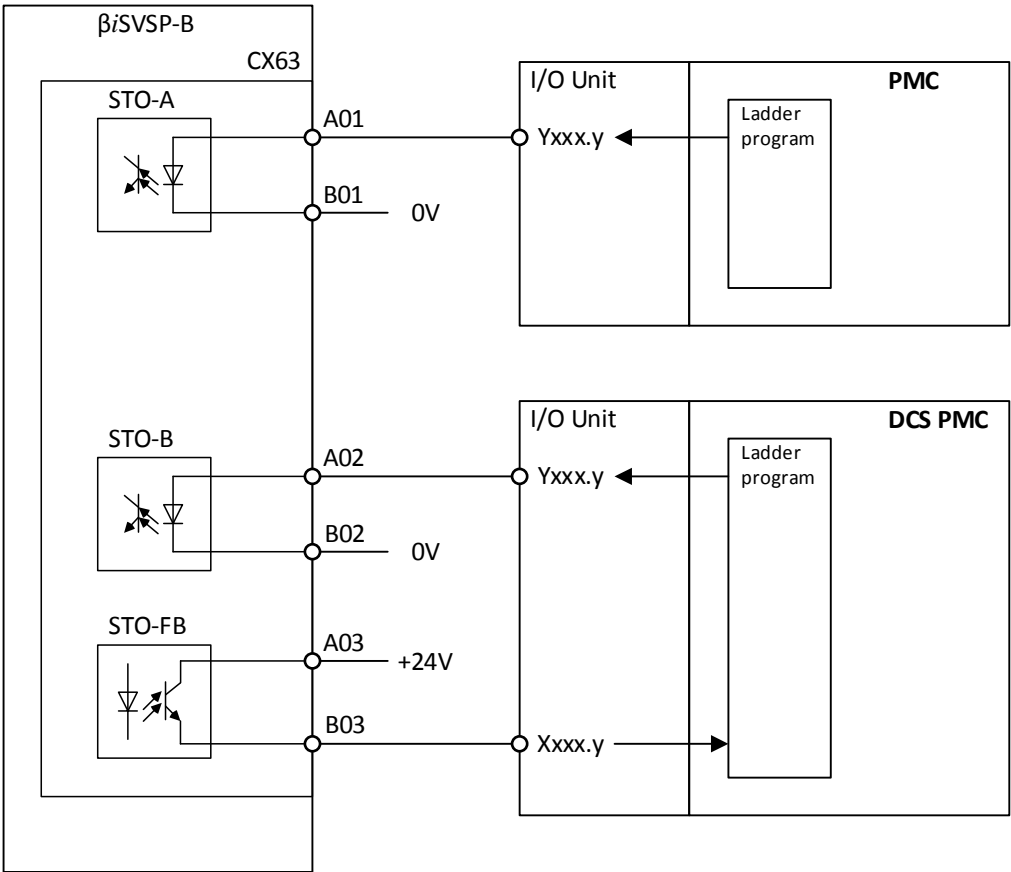
Parameter setting:

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N02436#1	STO			0: Does not use the Safe Torque Off function. 1: Uses the Safe Torque Off function.

BETA iSVSP-B

For the description of the function, see B-65422EN chapter SAFE TORQUE OFF FUNCTION.

Connection:



Switch settings:

	AXIS	SWITCH NUMBER	STO SETTING
	All servo axes	SW1-4	ON: Disabled OFF: Enabled
		SW1-3	ON: Disabled OFF: Enabled
	Spindle	SW1-2	
		SW1-1	

Parameter setting:

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N02436#1	STO			0: Does not use the Safe Torque Off function. 1: Uses the Safe Torque Off function.



Set N02436#1=1 (STO) for all axes connected to the amplifier!

PMC modification to use Safe Torque OFF Function

When using the Safe Torque OFF Function, the Ladder programs BasePMC.LAD and BaseDCS.LAD must be modified. In the sample code below, Safe Torque Off is used for the 4th axis.

Additional PMC code in MBasePMC.LAD

Sub-program Axis04_P01 (example safe torque off 4th axis, path01):

```
(* P01: Safe torque off *)
|
|
|
| E9980.0 | R0629.1 |
|-----|-----*P01:torque 4th axis on
| *SGOPN | 4th_trq |
|         | on_P01 |
| E9660.4 | E9993.0 |
|-----|-----*P01:STO monitor sign. 4th axis
| DCS_S02 | STO-FB4_ |
|         | P01     |
|         | Y0008.3 |
|         |-----*P01:output STO-B 4th axis
|         | oTRQB4_P |
|         | 01     |

(* P01: servo off *)
|
|
| R0336.0 | G0126.3 |
|-----|-----*P01:servo off 4th axis
| POW_OK_P | SVF4_P01 |
| 01       |
| R0629.1 |
|-----|-----*
| 4th_trq |
| on_P01  |

(* P01: DCS safety check activation *)
|
|
| E9980.0 | G0750.3 |
|-----|-----*P01:safety check req. 4th ax.
| *SGOPN | *VLDV4_P |
|         | 01       |
| R0629.1 |
|-----|-----*
| 4th_trq |
| on_P01  |

(* P01: DCS safety zero speed monitoring *)
|
|
| E9660.4 E9980.0 R0629.1 | G0755.3 |
|-----|-----*P01:zero mon. req. 4th axis
| DCS_S02 *SGOPN 4th_trq | SVZR4_P0 |
|         on_P01 1       |
```

Additional PMC code in MBaseDCS.LAD

Sub-program Machine_Inputs

```

(* axes safe torque off (STO) monitor *)
|
|
|
| X0008.6 R0020.1
|-----|-----()---*P01: safe torque off 4th axis
| iSTO-FB4 STO-FB4_
| _P01 P01

```

Sub-program CNC_Out_P01

```

(* P01:axis torque on, 4th axis *)
|
|
|
| R1000.0 R0031.0
|-----|-----()---*P01:torque 4th axis on
| *SGOPN TRQ_ON4_
| P01
| R1050.1
|-----|-----*
| DCS_S02
|
| R0031.0 R0020.1 R1013.0
|-----|/|-----()---*P01:STO monitor sig.1 4th axis
| TRQ_ON4_ STO-FB4_
| P01 P01 01

(* P01: axes: activation of safety check if the doors are open *)
|
|
| R1000.0 G0002.0
|-----|-----()---*P01:safety check req. 1st ax.
| *SGOPN |*VLDV1_P|
| | 01 |
| | G0002.1 |
|-----|-----()---*P01:safety check req. 2nd ax.
| |*VLDV2_P|
| | 01 |
| | G0002.2 |
|-----|-----()---*P01:safety check req. 3rd ax.
| |*VLDV3_P|
| | 01 |
| | G0002.3 |
|-----|-----()---*P01:safety check req. 4th ax.
| R1000.0 |*VLDV4_P|
| *SGOPN | 01 |
| R0031.0 |
|-----|/|-----*
| TRQ_ON4_
| P01

(* P01: axes: safety zero speed monitoring *)
|
|
| R1050.1 R1000.0 G0007.0
|-----|/|-----()---*P01:zero mon. req. 1st axis
| DCS_S02 *SGOPN |SVZR1_P0|
| | 1 |
| | G0007.1 |
|-----|-----()---*P01:zero mon. req. 2nd axis
| |*SVZR2_P0|
| | 1 |
| | G0007.2 |
|-----|-----()---*P01:zero mon. req. 3rd axis
| R1050.1 R1000.0 R0031.0 |SVZR3_P0|
| | 1 |
| | G0007.3 |
|-----|-----()---*P01:zero mon. req. 4th axis
| DCS_S02 *SGOPN TRQ_ON4_ |SVZR4_P0|
| P01 | 1 |

```

Sub-program Machine_Outputs

```

(* P01:Safe torque on 4th axis *)
|
|
|
| R0031.0 Y0008.3
|-----|-----()---*P01:output STO-A 4th axis
| TRQ_ON4_ oSTO-A4_
| P01 P01

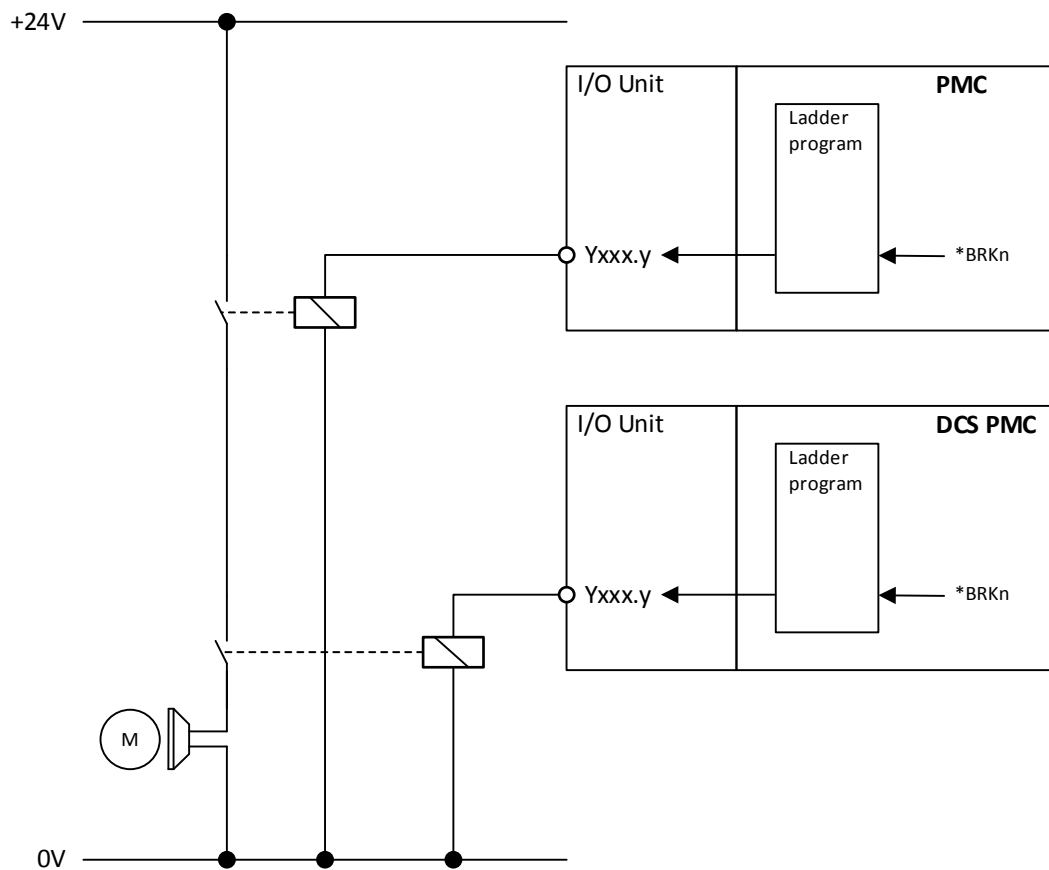
```

Brake control

When a brake test is required, the test will be started when the door key is pressed in JOG mode (all path must be in JOG mode) and the conditions for the brake test are satisfied.



This functionality will be included in case of `brake_test = 1` and `dcx_support = 1`



Parameter setting

Depending on the type of parameter, it has to be modified at multiple places. The **KEY** column shows, if the parameter exists once or several times in the parameter file of the control.

KEY	QUANTITY	DESCRIPTION
M	1 -> 3	Machine group specific parameter
C	1	Common parameter
P	1 -> n	Path related parameter
A	1 -> n	Axis related parameter
S	1 -> n	Spindle related parameter

External deceleration

In case of 30i/31i/32i, 35i-B and Power Motion iA control, the following option is required:

-J842 External deceleration

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
P	N01405#5	EDR			As the external deceleration rate for positioning of linear interpolation type: 0: The external deceleration rate for cutting feed is used (N01426). 1: The external deceleration rate for the first axis in rapid traverse is used (N01427).
P	N08005#0	EDC			1: In axis control by the PMC, an external deceleration function is enabled
C	N08131#2	EDC	1		External deceleration is used (0i-F)
P	N011620#1	EER			The external deceleration rate for linear interpolation type positioning: 0: depends on the setting of bit 5 (EDR) of parameter No. 1405. 1: is the maximum feedrate corresponding to the external deceleration rate of rapid traverse
P	N011620#2	EJH			For the external deceleration rate in the JOG mode, the external deceleration rate for handle feed is always: 0: not used (It depends on the setting of bit 3 (EJR) of parameter No. 11620.) 1: used.
P	N011620#3	EJR			For the external deceleration rate in the JOG mode, the external deceleration rate for positioning is always: 0: not used (It depends on the setting of bit 0 (JHD) of parameter No.7100.) 1: used.

PARAMETER	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
N01405#5															
N08005#0															
N11620#1															
N11620#2															
N11620#3															

Setting 1

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
P	N01426			mm/min]	External deceleration rate of cutting feed

PARAMETER	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
N01426															

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N01005#4	EDPx			1: In cutting feed, external deceleration signal in + direction is valid
A	N01005#5	EDMx			1: In cutting feed, external deceleration signal in - direction is valid
A	N01427			[mm/min]	External deceleration rate of rapid traverse for each axis
A	N01434			[mm/min]	Maximum manual handle feed rate for each axis

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N01005#4								
N01005#5								
N01427								
N01434								
*+EDx	Gn118.0	Gn118.1	Gn118.2	Gn118.3	Gn118.4	Gn118.5	Gn118.6	Gn118.7
*-EDx	Gn120.0	Gn120.1	Gn120.2	Gn120.3	Gn120.4	Gn120.5	Gn120.6	Gn120.7

External deceleration signals 1 (PMC)

NBR.	NAME	*+EDx	DESCRIPTION	*-EDx	DESCRIPTION
1	A1	Gn118.0	Feed deceleration 1 st axis in plus (+) direction	Gn120.0	Feed deceleration 1 st axis in minus (-) direction
2	A2	Gn118.1	Feed deceleration 2 nd axis in plus (+) direction	Gn120.1	Feed deceleration 2 nd axis in minus (-) direction
3	A3	Gn118.2	Feed deceleration 3 rd axis in plus (+) direction	Gn120.2	Feed deceleration 3 rd axis in minus (-) direction
4	A4	Gn118.3	Feed deceleration 4 th axis in plus (+) direction	Gn120.3	Feed deceleration 4 th axis in minus (-) direction
5	A5	Gn118.4	Feed deceleration 5 th axis in plus (+) direction	Gn120.4	Feed deceleration 5 th axis in minus (-) direction
6	A6	Gn118.5	Feed deceleration 6 th axis in plus (+) direction	Gn120.5	Feed deceleration 6 th axis in minus (-) direction
7	A7	Gn118.6	Feed deceleration 7 th axis in plus (+) direction	Gn120.6	Feed deceleration 7 th axis in minus (-) direction
8	A8	Gn118.7	Feed deceleration 8 th axis in plus (+) direction	Gn120.7	Feed deceleration 8 th axis in minus (-) direction

n= 0 to 14 (path number -1)

Dual check safety

Required option: -S661 Dual Check Safety

Dual check safety activation

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N01902#6	DCE	1		Dual check safety function 0: inactive 1: active
A	N01904#6	DCN			The checks of the target axis by DCS function are 0: carried out 1: not carried out
S	N03797#0	DCN			Each safety check of Dual Check Safety function for the specified spindle is 0: carried out. 1: not carried out.

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N01904#6								

PARAMETER	S1	S2	S3	S4	S5	S6	S7	S8
Spindle name								
N03797#0								

Related alarms:

NBR.	MESSAGE	DESCRIPTION
DS0022	DUAL CHECK SAFETY IS NOT WORKED	Dual Check Safety function is unavailable by setting bit 6 (DCE) of parameter No. 1902 to 0. This alarm can be reset by pressing the "CAN" and "RESET" MDI keys simultaneously.
SV0478	ILLEGAL AXIS DATA (SV)	The Servo detected that an error occurred on the axis during axis data transfer. If the alarm occurs after performing axis number setting for the servo amplifier, set parameter No.2212#4 to 1, and reset the bit to 0, and then turn off the power to the entire system. When a multi-axis amplifier is used, the alarm may not be cleared even if the above operation is performed once. In this case, repeat the operation on the axis for which the alarm persists until it is cleared. In the other case, replace the servo amplifier if the alarm occurred.
SV0496	ILLEGAL AXIS DATA (CNC)	The CNC detected that an error occurred during axis data transfer. If the alarm occurs after performing axis number setting for the servo amplifier, set parameter No.2212#4 to 1, and reset the bit to 0, and then turn off the power to the entire system. When a multi-axis amplifier is used, the alarm may not be cleared even if the above operation is performed once. In this case, repeat the operation on the axis for which the alarm persists until it is cleared. In the other case, replace the servo amplifier where the alarm occurred.
SV0498	AXIS NUMBER NOT SET (CNC)	The CNC detected that the axis number is not set with the servo amplifier. Turn off the power to the entire system. Then an axis number is automatically set.

I/O Link

In case of 30i/31i/32i-A, the following option is required:

-S985 I/O Link expansion 3rd channel

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N11910		100		I/O Link channel 1 input/output addresses
C	N11912		900		I/O Link channel 3 input/output addresses



Set 0 in the parameters N11910 and N11912 in case of I/O Link i.

I/O cross check

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N1945			[ms]	Safety-related I/O check timer
C	N11950- N11957				byte address of Safety input signal for CNC CPU
C	N11960- N11967				byte address of Safety output signal for CNC CPU
C	N11970- N11977				byte address of Safety input signal for PMC CPU
C	N11980- N11987				byte address of Safety output signal for PMC CPU
C	N13805#0				The cross check for the G signal of emergency stop [G008.4 / G19.4]
C	N13807#3	SAR			When an alarm occurs by a mismatch for safety-related I/O or in Dual Check Safety, the parameter can release the alarm with reset operation. Series 30i/31i/32i-B - CNC: Gxx1 / 79 or later - PMC: 40A5 / 23 or later Series 0i-TF, 0i-MF - CNC: Dx1 / 17 or later - PMC: 40B2 / 05 or later
C	N13810			[ms]	Power-on safety-related I/O check start timer

PARAMETER	VALUE	PARAMETER	VALUE	PARAMETER	VALUE	PARAMETER	VALUE
N11950	2001000	N11960	2001010	N11970	104009980	N11980	104009990
N11951	2001001	N11961	2001011	N11971	104009981	N11981	104009991
N11952	2001002	N11962	2001012	N11972	104009982	N11982	104009992
N11953	2001003	N11963	2001013	N11973	104009983	N11983	104009993
N11954	2001004	N11964	2001014	N11974	104009984	N11984	104009994
N11955	2001005	N11965	2001015	N11975	104009985	N11985	104009995
N11956	2001006	N11966	2001016	N11976	104009986	N11986	104009996
N11957	2001007	N11967	2001017	N11977	104009987	N11987	104009997

Safe inputs byte 01

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11970	E9980.0	N11950	R1000.0	Guard state doors closed
	E9980.1		R1000.1	Hold to run button
	E9980.2		R1000.2	Setup mode 01
	E9980.3		R1000.3	
	E9980.4		R1000.4	
	E9980.5		R1000.5	
	E9980.6		R1000.6	
	E9980.7		R1000.7	

Safe inputs byte 02

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11971	E9981.0	N11951	R1001.0	
	E9981.1		R1001.1	
	E9981.2		R1001.2	
	E9981.3		R1001.3	
	E9981.4		R1001.4	
	E9981.5		R1001.5	
	E9981.6		R1001.6	
	E9981.7		R1001.7	

Safe inputs byte 03

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11972	E9982.0	N11952	R1002.0	
	E9982.1		R1002.1	
	E9982.2		R1002.2	
	E9982.3		R1002.3	
	E9982.4		R1002.4	
	E9982.5		R1002.5	
	E9982.6		R1002.6	
	E9982.7		R1002.7	

Safe inputs byte 04

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11973	E9983.0	N11953	R1003.0	
	E9983.1		R1003.1	
	E9983.2		R1003.2	
	E9983.3		R1003.3	
	E9983.4		R1003.4	
	E9983.5		R1003.5	
	E9983.6		R1003.6	
	E9983.7		R1003.7	

Safe inputs byte 05

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11974	E9984.0	N11954	R1004.0	
	E9984.1		R1004.1	
	E9984.2		R1004.2	
	E9984.3		R1004.3	
	E9984.4		R1004.4	
	E9984.5		R1004.5	
	E9984.6		R1004.6	
	E9984.7		R1004.7	

Safe inputs byte 06

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11975	E9985.0	N11955	R1005.0	
	E9985.1		R1005.1	
	E9985.2		R1005.2	
	E9985.3		R1005.3	
	E9985.4		R1005.4	
	E9985.5		R1005.5	
	E9985.6		R1005.6	
	E9985.7		R1005.7	

Safe inputs byte 07

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11976	E9986.0	N11956	R1006.0	
	E9986.1		R1006.1	
	E9986.2		R1006.2	
	E9986.3		R1006.3	
	E9986.4		R1006.4	
	E9986.5		R1006.5	
	E9986.6		R1006.6	
	E9986.7		R1006.7	

Safe inputs byte 08

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11977	E9987.0	N11957	R1007.0	
	E9987.1		R1007.1	
	E9987.2		R1007.2	
	E9987.3		R1007.3	
	E9987.4		R1007.4	
	E9987.5		R1007.5	
	E9987.6		R1007.6	
	E9987.7		R1007.7	

Safe outputs byte 01

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11980	E9990.0	N11960	R1010.0	P01:spindle sto monitoring (serial spindle)
	E9990.1		R1010.1	P02:spindle sto monitoring (serial spindle)
	E9990.2		R1010.2	P03:spindle sto monitoring (serial spindle)
	E9990.3		R1010.3	P04:spindle sto monitoring (serial spindle)
	E9990.4		R1010.4	P05:spindle sto monitoring (serial spindle)
	E9990.5		R1010.5	P06:spindle sto monitoring (serial spindle)
	E9990.6		R1010.6	P07:spindle sto monitoring (serial spindle)
	E9990.7		R1010.7	P08:spindle sto monitoring (serial spindle)

Safe outputs byte 02

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11981	E9991.0	N11961	R1011.0	P09:spindle sto monitoring (serial spindle)
	E9991.1		R1011.1	P10:spindle sto monitoring (serial spindle)
	E9991.2		R1011.2	P11:spindle sto monitoring (serial spindle)
	E9991.3		R1011.3	P12:spindle sto monitoring (serial spindle)
	E9991.4		R1011.4	P13:spindle sto monitoring (serial spindle)
	E9991.5		R1011.5	P14:spindle sto monitoring (serial spindle)
	E9991.6		R1011.6	P15:spindle sto monitoring (serial spindle)
	E9991.7		R1011.7	

Safe outputs byte 03

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11982	E9992.0	N11962	R1012.0	
	E9992.1		R1012.1	
	E9992.2		R1012.2	
	E9992.3		R1012.3	
	E9992.4		R1012.4	
	E9992.5		R1012.5	
	E9992.6		R1012.6	
	E9992.7		R1012.7	

Safe outputs byte 04

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11983	E9993.0	N11963	R1013.0	
	E9993.1		R1013.1	
	E9993.2		R1013.2	
	E9993.3		R1013.3	
	E9993.4		R1013.4	
	E9993.5		R1013.5	
	E9993.6		R1013.6	
	E9993.7		R1013.7	

Safe outputs byte 05

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11984	E9994.0	N11964	R1014.0	
	E9994.1		R1014.1	
	E9994.2		R1014.2	
	E9994.3		R1014.3	
	E9994.4		R1014.4	
	E9994.5		R1014.5	
	E9994.6		R1014.6	
	E9994.7		R1014.7	

Safe outputs byte 06

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11985	E9995.0	N11965	R1015.0	
	E9995.1		R1015.1	
	E9995.2		R1015.2	
	E9995.3		R1015.3	
	E9995.4		R1015.4	
	E9995.5		R1015.5	
	E9995.6		R1015.6	
	E9995.7		R1015.7	

Safe outputs byte 07

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11986	E9996.0	N11966	R1016.0	
	E9996.1		R1016.1	
	E9996.2		R1016.2	
	E9996.3		R1016.3	
	E9996.4		R1016.4	
	E9996.5		R1016.5	
	E9996.6		R1016.6	
	E9996.7		R1016.7	

Safe outputs byte 08

PARAMETER	BasePMC	PARAMETER	DCSPMC	DESCRIPTION
N11987	E9997.0	N11967	R1017.0	
	E9997.1		R1017.1	
	E9997.2		R1017.2	
	E9997.3		R1017.3	
	E9997.4		R1017.4	
	E9997.5		R1017.5	
	E9997.6		R1017.6	
	E9997.7		R1017.7	

Related alarms:

NBR.	MESSAGE	DESCRIPTION
PW0010 DS2100	SAFE I/O CROSS CHECK ERROR(DCS PMC)	On the DCS PMC side, the I/O cross check function detected an error in system definition safety-related I/O.
PW0011 DS2101	SAFE I/O CROSS CHECK ERROR(PMC)	On the PMC side, the I/O cross check function detected an error in system definition safety-related I/O.
PW0012 DS2102	USER I/O CROSS CHECK ERROR(DCS PMC)	The DCS PMC detected the error of user define safe I/O in the I/O cross check function.
PW0013 DS2103	USER I/O CROSS CHECK ERROR(PMC)	The PMC detected the error of user define safe I/O in the I/O cross check function.

MCC

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
M	N01946			[ms]	MCC off test timer
M	N01948			[ms]	MCC off timer
P	N10500#0	AVM			In case a servo alarm occurs, 0: MCC off, when some servo alarms occurs 1: MCC off, when any servo alarm occurs
P	N10500#1	APM			In case a spindle alarm (SPxxxx) occurs, 0: MCC off, when some spindle alarm occurs 1: MCC off, when any spindle alarm occurs
P	N10500#3	STP			When the power is turned on, MCC of test is: 0: Carried out 1: Not carried out
M	N13804#0	NDW			When the warning of MCC self test occurs, 0: the screen is changed to the diagnose screen for the dual check safety 1: the screen is not changed to the diagnose screen for the dual check safety

PARAMETER	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
N10500#0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N10500#1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N10500#3															

Related alarms:

NBR.	MESSAGE	DESCRIPTION
SV0488	SELF TEST OVER TIME	MCC off test timer [ms]. MCC off Test was not completed within the specified time (parameter No. 1946). Check the MCC contact.

Dual check safety diagnosis screen

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N10597#0	IDD	1		Enhanced information display 0: disabled 1: enabled
C	N10597#1	DPN	1		The ALARM INFORMATION screen displays: 0: CNC-side address 1: PMC-side address and PMC path number
C	N10597#2	SDS	0		Symbol name of signals in CROSS CHECK DATA screen is: 0: Not displayed 1: Displayed

Data transfer between PMC and DCSPMC

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N013805#5	NPDT	1		While the Dual Check Safety function is inactive (parameter DCE=0), Data transfer between PMC and DCSPMC is: 0: Not available 1: Available
C	N013805#6	PDTR			Data transfer between PMC and DCSPMC is: 0: Not available 1: Available (Former specification)
C	N013807#6	PD2			Data transfer between PMC and DCSPMC is: 0: Not available 1: Available (New specification)

Following controls support the new specification:

Series 30i/31i/32i-B (Gxxx/51), 35i-B (G6xx/14) and 0i-F (DxG1/02)

For more information about the new specification, see document A-41127E.

Former specification (N013805#6=1, N013807#6=0)

Data transfer BasePMC → BaseDCS

Byte 00

SYMBOL	BasePMC	SYMBOL	DCSPMC	DESCRIPTION
TPMG00	G0765.0	TPMF00	F0017.0	Tansfer of virtual EMG key
TPMG01	G0765.1	TPMF01	F0017.1	Transfer state of HTR input
TPMG02	G0765.2	TPMF02	F0017.2	
TPMG03	G0765.3	TPMF03	F0017.3	
TPMG04	G0765.4	TPMF04	F0017.4	
TPMG05	G0765.5	TPMF05	F0017.5	
TPMG06	G0765.6	TPMF06	F0017.6	
TPMG07	G0765.7	TPMF07	F0017.7	

Byte 01

SYMBOL	BasePMC	SYMBOL	DCSPMC	DESCRIPTION
TPMG1_00	G1765.0	TPMF1_00	F0037.0	
TPMG1_01	G1765.1	TPMF1_01	F0037.1	
TPMG1_02	G1765.2	TPMF1_02	F0037.2	
TPMG1_03	G1765.3	TPMF1_03	F0037.3	
TPMG1_04	G1765.4	TPMF1_04	F0037.4	
TPMG1_05	G1765.5	TPMF1_05	F0037.5	
TPMG1_06	G1765.6	TPMF1_06	F0037.6	
TPMG1_07	G1765.7	TPMF1_07	F0037.7	

Data transfer BaseDCS → BasePMC

Byte 00

SYMBOL	BaseDCS	SYMBOL	BasePMC	DESCRIPTION
TDCG00	G0017.0	TDCF00	F0747.0	Transfer of RSVx, POEx and RSPx for door unlocking
TDCG01	G0017.1	TDCF01	F0747.1	Transfer state of HTR input
TDCG02	G0017.2	TDCF02	F0747.2	
TDCG03	G0017.3	TDCF03	F0747.3	
TDCG04	G0017.4	TDCF04	F0747.4	
TDCG05	G0017.5	TDCF05	F0747.5	
TDCG06	G0017.6	TDCF06	F0747.6	
TDCG07	G0017.7	TDCF07	F0747.7	

Byte 01

SYMBOL	BaseDCS	SYMBOL	BasePMC	DESCRIPTION
TDCG1_00	G0037.0	TDCF1_00	F1747.0	
TDCG1_01	G0037.1	TDCF1_01	F1747.1	
TDCG1_02	G0037.2	TDCF1_02	F1747.2	
TDCG1_03	G0037.3	TDCF1_03	F1747.3	
TDCG1_04	G0037.4	TDCF1_04	F1747.4	
TDCG1_05	G0037.5	TDCF1_05	F1747.5	
TDCG1_06	G0037.6	TDCF1_06	F1747.6	
TDCG1_07	G0037.7	TDCF1_07	F1747.7	

New specification (N013805#6=0, N013807#6=1)

Data transfer BasePMC → BaseDCS

Byte 00

SYMBOL	BasePMC	SYMBOL	DCSPMC	DESCRIPTION
TPMG08	G0764.0	TPMF08	F0016.0	
TPMG09	G0764.1	TPMF09	F0016.1	
TPMG10	G0764.2	TPMF10	F0016.2	
TPMG11	G0764.3	TPMF11	F0016.3	
TPMG12	G0764.4	TPMF12	F0016.4	
TPMG13	G0764.5	TPMF13	F0016.5	
TPMG14	G0764.6	TPMF14	F0016.6	
TPMG15	G0764.7	TPMF15	F0016.7	

Byte 01

SYMBOL	BasePMC	SYMBOL	DCSPMC	DESCRIPTION
TPMG00	G0765.0	TPMF00	F0017.0	Transfer of virtual EMG key
TPMG01	G0765.1	TPMF01	F0017.1	Transfer state of HTR input
TPMG02	G0765.2	TPMF02	F0017.2	
TPMG03	G0765.3	TPMF03	F0017.3	
TPMG04	G0765.4	TPMF04	F0017.4	
TPMG05	G0765.5	TPMF05	F0017.5	
TPMG06	G0765.6	TPMF06	F0017.6	
TPMG07	G0765.7	TPMF07	F0017.7	

Byte 02

SYMBOL	BasePMC	SYMBOL	DCSPMC	DESCRIPTION
TPMG1_08	G1764.0	TPMF1_08	F0036.0	
TPMG1_09	G1764.1	TPMF1_09	F0036.1	
TPMG1_10	G1764.2	TPMF1_10	F0036.2	
TPMG1_11	G1764.3	TPMF1_11	F0036.3	
TPMG1_12	G1764.4	TPMF1_12	F0036.4	
TPMG1_13	G1764.5	TPMF1_13	F0036.5	
TPMG1_14	G1764.6	TPMF1_14	F0036.6	
TPMG1_15	G1764.7	TPMF1_15	F0036.7	

Byte 03

SYMBOL	BasePMC	SYMBOL	DCSPMC	DESCRIPTION
TPMG1_00	G1765.0	TPMF1_00	F0037.0	
TPMG1_01	G1765.1	TPMF1_01	F0037.1	
TPMG1_02	G1765.2	TPMF1_02	F0037.2	
TPMG1_03	G1765.3	TPMF1_03	F0037.3	
TPMG1_04	G1765.4	TPMF1_04	F0037.4	
TPMG1_05	G1765.5	TPMF1_05	F0037.5	
TPMG1_06	G1765.6	TPMF1_06	F0037.6	
TPMG1_07	G1765.7	TPMF1_07	F0037.7	

Data transfer BaseDCS → BasePMC

Byte 00

SYMBOL	BaseDCS	SYMBOL	BasePMC	DESCRIPTION
TDCG08	G0016.0	TDCF08	F0746.0	
TDCG 09	G0016.1	TDCF09	F0746.1	
TDCG10	G0016.2	TDCF10	F0746.2	
TDCG11	G0016.3	TDCF11	F0746.3	
TDCG12	G0016.4	TDCF12	F0746.4	
TDCG13	G0016.5	TDCF13	F0746.5	
TDCG14	G0016.6	TDCF14	F0746.6	
TDCG15	G0016.7	TDCF15	F0746.7	

Byte 01

SYMBOL	BaseDCS	SYMBOL	BasePMC	DESCRIPTION
TDCG00	G0017.0	TDCF00	F0747.0	Transfer of RSVx, POSEx and RSPx for door unlocking
TDCG 01	G0017.1	TDCF01	F0747.1	Transfer state of HTR input
TDCG02	G0017.2	TDCF02	F0747.2	
TDCG03	G0017.3	TDCF03	F0747.3	
TDCG04	G0017.4	TDCF04	F0747.4	
TDCG05	G0017.5	TDCF05	F0747.5	
TDCG06	G0017.6	TDCF06	F0747.6	
TDCG07	G0017.7	TDCF07	F0747.7	

Byte 02

SYMBOL	BaseDCS	SYMBOL	BasePMC	DESCRIPTION
TDCG1_08	G0036.0	TDCF1_08	F1747.0	
TDCG1_09	G0036.1	TDCF1_09	F1747.1	
TDCG1_10	G0036.2	TDCF1_10	F1747.2	
TDCG1_11	G0036.3	TDCF1_11	F1747.3	
TDCG1_12	G0036.4	TDCF1_12	F1747.4	
TDCG1_13	G0036.5	TDCF1_13	F1747.5	
TDCG1_14	G0036.6	TDCF1_14	F1747.6	
TDCG1_15	G0036.7	TDCF1_15	F1747.7	

Byte 03

SYMBOL	BaseDCS	SYMBOL	BasePMC	DESCRIPTION
TDCG1_00	G0037.0	TDCF1_00	F1747.0	
TDCG1_01	G0037.1	TDCF1_01	F1747.1	
TDCG1_02	G0037.2	TDCF1_02	F1747.2	
TDCG1_03	G0037.3	TDCF1_03	F1747.3	
TDCG1_04	G0037.4	TDCF1_04	F1747.4	
TDCG1_05	G0037.5	TDCF1_05	F1747.5	
TDCG1_06	G0037.6	TDCF1_06	F1747.6	
TDCG1_07	G0037.7	TDCF1_07	F1747.7	

Test mode of Acceptance test

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N013805#2	DTS	0		Test mode of Acceptance test is 0: ineffective 1: effective

Related alarms:

NBR.	MESSAGE	DESCRIPTION
PW0026	SAFETY PARAM ERROR(DCS PMC)	The DCS PMC detected an error in safety parameter. Set N013805#2 = 1. Switch off and on again. Set N013805#2 = 0.
PW0027	SAFETY PARAM ERROR(PMC)	The PMC detected an error in safety parameter. Set N013805#2 = 1. Switch off and on again. Set N013805#2 = 0.

Axes position deviation check

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N01828			[Detection Unit]	Positioning deviation limit for each axis in movement
A	N01829			[Detection Unit]	Positioning deviation limit for each axis in the stopped state
A	N01830			[Detection Unit]	Axis-by-axis positional deviation limit at servo-off time
A	N01838			[Detection Unit]	Position deviation limit for each axis in moving state (DCS)
A	N01839			[Detection Unit]	Position deviation limit for each axis in stopped state (DCS)
A	N01840			[Detection Unit]	Position deviation limit for each axis in servo-off state
A	N01841			[Detection Unit]	Position deviation limit of each axis in moving state during other than Dual Check Safety monitoring (for Dual Check Safety Function)
A	N01842			[Detection Unit]	Position deviation limit of each axis in stopped state during other than Dual Check Safety monitoring (for Dual Check Safety Function)
C	N13805#1	SOF	0		When the setting of that follow-up is executed by follow-up signal (*FLWU) in servo-off state is effective (the value of the parameter FUPx(No.1819#0) is 0), the following limit is applied to the safety position error monitoring function during servo off state and follow-up state including emergency stop and servo alarm etc, or pole position detection. 0: The position deviation limit in moving state (The parameter No.1838, 1841) 1: The position deviation limit in servo-off state (The parameter No.1840)

Calculation of position deviation in movement for linear axes:

$$\text{Position deviation} = \frac{\text{max feed} \left[\frac{\text{mm}}{\text{min}} \right] * 1000}{60} * \frac{1}{\text{N01825(N02178)} * 0.01 \left[\frac{1}{\text{s}} \right]} * \frac{1}{\text{detection unit} [\mu\text{m}]} * 1.2$$

Calculation of position deviation in movement for rotary axes:

$$\text{Position deviation} = \frac{\text{max feed} \left[\frac{^\circ}{\text{min}} \right] * 1000}{60} * \frac{1}{\text{N01825(N02178)} * 0.01 \left[\frac{1}{\text{s}} \right]} * \frac{1}{\text{detection unit} [^\circ]} * 1.2$$



For the parameters N01828 and N01841 set a value of about 1.2 times the calculated position deviation.

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N01828								
N01829								
N01830								
N01838								
N01839								
N01840								
N01841								
N01842								

PMC signals:

*VLDVx Safety check request signal (Gn750.x[PMC]/G((path-1)*20+2).x[DCS])
 0: safety monitor active
 1: safety monitor inactiv

Related alarms:

NBR.	MESSAGE	DESCRIPTION
SV0475	EXCESS ERROR (MOVE:SV)	The Servo detected that the positional deviation during travelling exceeded the parameter (No. 1838, No.1841) setting value.
SV1071	EXCESS ERROR (MOVE:CNC)	The CNC detected that the positional deviation during moving exceeded the parameter (No.1838, No.1841) setting value.
SV0474	EXCESS ERROR (STOP:SV)	The Servo detected that the positional deviation during stopping exceeded the parameter (No. 1839, No.1842) setting value.
SV1072	EXCESS ERROR (STOP:CNC)	The CNC detected that the positional deviation during stopping exceeded the parameter (No.1839, No.1842) setting value.

Axes speed check (position)

Safety speed selection signals:

SAFETY SPEED PARAMETER	SAFETY SPEED / SAFETY POSITION SELECTION SIGNAL		NAME
	SVAx [G752,x[PMC] / G004.x[DCS]]	SVBx [G753.x[PMC] / G005.x[DCS]]	
N13821	0	0	Safety speed 1
N13822	1	0	Safety speed 2
N13823	0	1	Safety speed 3
N13824	1	1	Safety speed 4

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N013806#1	D10			In the safety limit speed monitoring of the feed axis of Dual Check Safety function, the unit of safety speed monitoring of the safety limit speed in position control (parameter No.13821 to No.13824) is 0: Not changed 1: Regarded as ten times
A	N13821			[mm/min.]	Safety limit speed 1 in position control for each axis [door open / stop]
A	N13822			[mm/min.]	Safety limit speed 2 in position control for each axis [door open / move]
A	N13823			[mm/min.]	Safety limit speed 3 in position control for each axis
A	N13824			[mm/min.]	Safety limit speed 4 in position control for each axis
A	N13825			[mm/min.]	Speed regarded as axis stop for Dual Check Safety

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N13806#1								
N13821								
N13822								
N13822								
N13823								
N13824								
N13825								



Parameter N13821 to 13825

1 The safe reduced speed checks are made on the basis of the speed converted to the detection unit. Accordingly, a calculation error may occur.

2 For diameter specification, set the speed by the diameter (use changes in diameter/rev or in diameter/min).



Parameter N13825

1 For diameter specification, set the speed by the diameter (use changes in diameter/rev or in diameter/min).

2 In case of velocity control, set the value calculated by the following formula to this parameter when R(min-1) is the velocity, at which the axis is regarded as stopped.

Setting value = $R * PLS * \text{Minimum data unit (Machine unit)} * N / \text{CMR}$

PLS: Pulse per one revolution of motor (Detection unit)

CMR: Command multiplier

N: In case of diameter specification, N=2. In other case, N=1

Related alarms:

NBR.	MESSAGE	DESCRIPTION
SV0476	ILLEGAL SPEED CMD. (SV)	The Servo detected that the specified speed on the axis exceeded the safety speed (parameter No. 13821 to 13824, No. 13826 to 13829) during safety monitoring (the safety check request signal (*VLDVx) is 0). When the guard is open, confirm a proper value is set to parameter (No. 13821 to 13824, No. 13826 to 13829), and the operation is done within the safety speed.
SV0494	ILLEGAL SPEED CMD.(CNC)	The CNC detected that the specified speed exceeded the setting (parameter No. 13821 to 13824 in case of position control, No. 13826 to 13829 in case of velocity control) during safety monitoring (the safety check request signal (*VLDVx) is 0). When the guard is open, confirm a proper value is set to parameter (No. 13821 to 13824, No. 13826 to 13829), and the operation is done within the safety speed.

Axes speed check (velocity control)

Safety speed selection signals:

SAFETY SPEED PARAMETER	SAFETY SPEED / SAFETY POSITION SELECTION SIGNAL		NAME
	SVAx [G752.x[PMC] / G004.x[DCS]]	SVBx [G753.x[PMC] / G005.x[DCS]]	
N13826	0	0	Safety speed 1
N13827	1	0	Safety speed 2
N13828	0	1	Safety speed 3
N13829	1	1	Safety speed 4

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N13826			[min.°]	Safety limit speed 1 in velocity control for each axis [door open / stop]
A	N13827			[min.°]	Safety limit speed 2 in velocity control for each axis [door open / move]
A	N13828			[min.°]	Safety limit speed 3 in velocity control for each axis
A	N13829			[min.°]	Safety limit speed 4 in velocity control for each axis

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N13826								
N13827								
N13828								
N13829								

Related alarms:

NBR.	MESSAGE	DESCRIPTION
SV0476	ILLEGAL SPEED CMD. (SV)	The Servo detected that the specified speed on the axis exceeded the safety speed (parameter No. 13821 to 13824, No. 13826 to 13829) during safety monitoring (the safety check request signal [*VLDVx] is 0). When the guard is open, confirm a proper value is set to parameter (No. 13821 to 13824, No. 13826 to 13829), and the operation is done within the safety speed.
SV0494	ILLEGAL SPEED CMD.(CNC)	The CNC detected that the specified speed exceeded the setting (parameter No. 13821 to 13824 in case of position control, No. 13826 to 13829 in case of velocity control) during safety monitoring (the safety check request signal [*VLDVx] is 0). When the guard is open, confirm a proper value is set to parameter (No. 13821 to 13824, No. 13826 to 13829), and the operation is done within the safety speed.

Axes position check

Safety machine position selection signals:

SAFETY MACHINE POSITION PARAMETER		SAFETY SPEED / SAFETY POSITION SELECTION SIGNAL		NAME
+ DIRECTION	- DIRECTION	SVAX (G752.X[PMC] / G004.X[DCS])	SVBX (G753.X[PMC] / G005.X[DCS])	
N13831	N13832	0	0	Safety speed 1
N13833	N13834	1	0	Safety speed 2
N13835	N13836	0	1	Safety speed 3
N13837	N13838	1	1	Safety speed 4

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N13831			[mm]	Safety machine position 1 for each axis (+ direction) [door open / stop]
A	N13832			[mm]	Safety machine position 1 for each axis (- direction) [door open / stop]
A	N13833			[mm]	Safety machine position 2 for each axis (+ direction) [door open / move]
A	N13834			[mm]	Safety machine position 2 for each axis (- direction) [door open / move]
A	N13835			[mm]	Safety machine position 3 for each axis (+ direction)
A	N13836			[mm]	Safety machine position 3 for each axis (- direction)
A	N13837			[mm]	Safety machine position 4 for each axis (+ direction)
A	N13838			[mm]	Safety machine position 4 for each axis (- direction)
A	N13844			[mm]	Safety zero speed monitoring width for a servo axis [door open / stop] (SVZR _x G755.x[PMC] / G007.x[DCS] = 1)

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N01320								
N01321								
N13831								
N13832								
N13833								
N13834								
N13835								
N13836								
N13837								
N13838								
N13844								

PMC signals:

SVZR_x Safety speed zero monitoring request
 0: safety zero speed monitoring is not effective
 1: safety zero speed monitoring is effective

Related alarms:

NBR.	MESSAGE	DESCRIPTION
SV0477	ILLEGAL MACHINE POS.(SV)	The Servo detected that the machine position on the axis is not in the safety area (parameter No.13831 to 13838) during safety monitoring (the safety check request signal [*VLDV _x] is 0). When the guard is open, confirm a proper value is set to parameter No.13831 to 13838 and do an operation in the safety area. The safe machine position monitoring is done after the machine reference position is established.
SV0495	ILLEGAL MACHINE POS.(CNC)	The CNC detected that the machine position is not in the safety area (parameter No.13831 to 13838) during safety monitoring (the safety check request signal [*VLDV _x] is 0). When the guard is open, confirm proper values is set to parameter No.13831 to 13838, and operation is done in the safety area. The safe machine position monitoring is done for the axis whose machine reference position is established.

Axes safe position switches

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
A	N13811			[mm]	Hysteresis width of position switch (Dual Check Safety)

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N13811								

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N13840		0		Address to which safety position switch 1 to 16 are assigned (F0755-F0756)
C	N13841		1		Address to which safety position switch 17 to 32 are assigned (F0757-F0758)
C	N13842		10		Address to which safety position switch 33 to 48 are assigned (F1755-F1756)
C	N13843		11		Address to which safety position switch 49 to 64 are assigned (F1757-F1758)

SWITCH	AXIS NAME	AXIS NBR.	VALUE	MIN. LIMIT	VALUE	MAX. LIMIT	VALUE	BASEPMC	BASEDCS
1	X+	N13880	1	N13960		N13920		F755.0	F007.0
2	X-	N13881	1	N13961		N13921		F755.1	F007.1
3		N13882		N13962		N13922		F755.2	F007.2
4		N13883		N13963		N13923		F755.3	F007.3
5		N13884		N13964		N13924		F755.4	F007.4
6		N13885		N13965		N13925		F755.5	F007.5
7		N13886		N13966		N13926		F755.6	F007.6
8		N13887		N13967		N13927		F755.7	F007.7
9		N13888		N13968		N13928		F756.0	F008.0
10		N13889		N13969		N13929		F756.1	F008.1
11		N13890		N13970		N13930		F756.2	F008.2
12		N13891		N13971		N13931		F756.3	F008.3
13		N13892		N13972		N13932		F756.4	F008.4
14		N13893		N13973		N13933		F756.5	F008.5
15		N13894		N13974		N13934		F756.6	F008.6
16		N13895		N13975		N13935		F756.7	F008.7
17		N13896		N13976		N13936		F757.0	F009.0
18		N13897		N13977		N13937		F757.1	F009.1
19		N13898		N13978		N13938		F757.2	F009.2
20		N13899		N13979		N13939		F757.3	F009.3
21		N13900		N13980		N13940		F757.4	F009.4
22		N13901		N13981		N13941		F757.5	F009.5
23		N13902		N13982		N13942		F757.6	F009.6
24		N13903		N13983		N13943		F757.7	F009.7
25		N13904		N13984		N13944		F758.0	F010.0
26		N13905		N13985		N13945		F758.1	F010.1
27		N13906		N13986		N13946		F758.2	F010.2
28		N13907		N13987		N13947		F758.3	F010.3
29		N13908		N13988		N13948		F758.4	F010.4
30		N13909		N13989		N13949		F758.5	F010.5
31		N13910		N13990		N13950		F758.6	F010.6
32		N13911		N13991		N13951		F758.7	F010.7

Stroke limit check using safe position switches

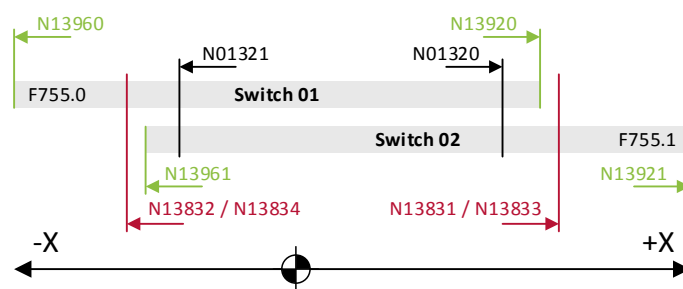
In case of closed doors, the safe machine position monitoring isn't active. Because of that safe position switches can be used for the stroke limit check.

Example:

The first 2 safe position switches are used to check the +X/-X stroke limits (X is the 1st axis in the system).

Related parameters:

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N13880		1		Axis corresponding to the 1st safe position switch
C	N13881		1		Axis corresponding to the 2nd safe position switch
C	N13960			[mm]	Minimum limit of the 1st safe position switch [mm or degree]
C	N13920			[mm]	Maximum limit of the 1st safe position switch [mm or degree]
C	N13961			[mm]	Minimum limit of the 2nd safe position switch [mm or degree]
C	N13921			[mm]	Maximum limit of the 2nd safe position switch [mm or degree]



PMC code (example 1st axis path 01):

F0755.0 R0576.4	G0114.0
--- --- ---	----()---*P01:overtravel + 1st axis
SPS01 MPOSE1_P	*+L1_P01
01	
F0120.0	
*--- / ---	
ZRF1_P01	
E9660.2	
*--- / ---	
P_ON_1ST	
E9580.0	
*--- / ---	
DCS_ACT	
F0755.1 R0576.4	G0116.0
--- --- ---	----()---*P01:overtravel - 1st axis
SPS02 MPOSE1_P	*-L1_P01
01	
F0120.0	
*--- / ---	
ZRF1_P01	
E9660.2	
*--- / ---	
P_ON_1ST	
E9580.0	
*--- / ---	
DCS_ACT	

Axes brake test

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
M	N01950			[ms]	Brake signal timer
C	N13807#0		1		Brake control during DCS alarm enabled [Gxx4/47.0 90E1/12.0]
A	N13912				Brake test enable/disable
M	N13913		8	[hour]	Brake test interval
A	N13914			[ms]	Time t1 allowed to elapse after the output of the brake signal until the brake is applied
A	N13915			[%]	Brake test current limit override value
A	N13916			[mm]	Amount of travel specified for the brake test
A	N13917			[mm/min]	Feedrate specified for the brake test
A	N13918			[detection unit]	Tolerance value for the positional deviation amount checked by the brake test
A	N13919			[ms]	Time (t2) during which the positional deviation amount is checked during the brake test

PARAMETER	A1	A2	A3	A4	A5	A6	A7	A8
Axis name								
N13912								
N13914								
N13915								
N13916								
N13917								
N13918								
N13919								

Related alarms:

NBR.	MESSAGE	DESCRIPTION
DS0039	BRAKE TEST ERROR	A brake test did not terminate normally. For the cause of this alarm, check the number displayed for diagnosis No. 3701.
DS0040	n AXIS BRAKE TEST ERROR	An error was detected in the n axis during a brake test, and the brake test did not terminate normally. For the cause of this alarm, check the number displayed for diagnosis No. 3701.

PMC code modification (sub-program Axes P011)

```

|(* DCS brake test in case of door open request *)
|(* (add *ITx signals (normally closed contact) for the brake test axes *)
|(* in parallel to the other conditions for the dis_brkt_PATH_ variable) *)
|
|
|E9660.0 |E9672.0
*---|/|---*-----()---*disable brake test
| POW_OK |dis_brkt|
|E9650.1 |
*---|/|---*
| OP |
|E9980.0 |
*---|/|---*
| *SGOPN |
|G0191.3 |
*---|/|---*
| ORQ |
|E9710.0 |
*---|/|---*
| AL |
|E9660.5 |
*---|/|---*
| MCC_TEST |
|E9590.1 |
*---|/|---*
| M_JOG |
|G0130.2 |
*---|/|---*
| *IT3_P01 |
| |
|G1130.2 |
*---|/|---*
| *IT3_P02 |
|

```

E.g. the 3rd axis of path01 and path02 will be tested by DCS brake test. In this case add a normally closed contact to the conditions of dis_brkt in the sub-program Axes.

Calculation of brake test current limit value

X1 axis (example)

Motor: α iS4/5000HV-B (see B-65262EN / B-65302EN)
 Stall torque: 4.0 Nm (see B-65262EN / B-65302EN)
 Stall Current: 3.0 A(rms) (see B-65262EN / B-65302EN)
 Max. Current Amp.: 10 A (peak) (see B-65262EN / B-65302EN)
 Brake torque: 3Nm (see B-65262EN / B-65302EN)

Motor data:

Parameter	Symbol	Value	Unit
Continuous Torque (at low speed) (*)	T_c	4.0	Nm
		41	kgfcm
Continuous Current (at low speed) (*)	I_c	3.0	A (rms)
Rated Output (*)	P_r	1.0	kW
		1.3	HP
Rated Speed	N_r	4000	min ⁻¹
Maximum Speed	N_{max}	5000	min ⁻¹
Maximum Torque (*)	T_{max}	8.8	Nm
		90	kgfcm
Moment of Inertia of Rotor	J_m	0.000515	kgm ²
		0.00526	kgfcms ²
Moment of Inertia of Rotor(with Brake)	J_m	0.000535	kgm ²
		0.00546	kgfcms ²
Torque Constant (*)	K_t	1.32	Nm/A(rms)
		13.4	kgfcm/A(rms)
Winding Resistance (between terminals) (*)	R_a	5.6	Ω
Thermal time constant	t_t	20	min
Static friction	T_f	0.2	Nm
		2	kgfcm
Weight	w	4.3	kg
Weight(with Brake)	w	5.3	kg
Max. Current of Servo Amp.	I_{max}	10	A (peak)

Brake torque:

Motor model		Unit	α iS2-B, α iS4-B α iF2-B, α iF4-B (Including HV)	α iS8-B, α iS12-B α iF4-B, α iF8-B (Including HV)
Brake torque		Nm	3	8
		kgf·cm	31	82
Response time	Release	msec	60	80
	Hold	msec	20	20
Power supply	Voltage	V	24VDC ($\pm 10\%$)	
	Current	A	0.9	1.1
	Wattage	W	22	26
Weight increase		kg	Approx. 1.0	Approx. 2.2
Moment of inertia increase		kg·m ²	0.00002	0.00007
		kgf·cm·s ²	0.0002	0.0007

Calculation of parameter N13915

Hold-up motor current: 6% [Servo tuning screen]

Hold – up current peak value \rightarrow hold – up current[%] * stall current[A] * $\sqrt{2}$ = $0.06 * 3.0 * \sqrt{2} = 0.2545$ [A]

$$N13915 = \frac{2.3 * 255 * \text{hold – up current}[A_{\text{peak}}] * 7282}{\text{max. current Amp.}[A_{\text{peak}}] * N02060} = \frac{2.3 * 255 * 0.2545[A] * 7282}{10[A] * 7282} = 14.9 \rightarrow 15$$

Calculation, if test torque does not exceed brake torque:

Hold – up torque = hold – up current[%] * stall torque[Nm] = $0.06 * 3[\text{Nm}] = 0.18[\text{Nm}]$

Test torque = $2.3 * \text{hold – up current}[\%] * \text{stall torque}[\text{Nm}] = 2.3 * 0.06 * 3[\text{Nm}] = 0.414[\text{Nm}]$

Brake test torque = test torque[Nm] – hold – up torque[Nm] = $0.414[\text{Nm}] - 0.18[\text{Nm}] = 0.234[\text{Nm}]$

Resulting test torque < brake torque = $0.234[\text{Nm}] < 3[\text{Nm}] \rightarrow \text{ok}$

Calculation of brake test deviation tolerance N13918

Brake backlash:

Alpha 2	: max. 1.7°
Alpha 4, 8	: max. 0.7°
Alpha 12, 22, 30, 40	: max. 0.6°

Ball screw:	5mm
Gear ratio:	1:1
Detection unit:	0.1μm

$$\text{Deviation} = \frac{\text{brake backlash}[^{\circ}] * \text{movement per motor revolution}[\text{mm}]}{360 * \text{detection unit}[\text{mm}]} = \frac{0.7[^{\circ}] * 5[\text{mm}]}{360 * 0.0001[\text{mm}]} = 97.2222$$

$$N13918 = 2 * \text{brake related deviation} = 2 * 97.222 = 194.444 = 195$$

Spindle

1st serial spindle in the path

Safety speed selection signals:

SAFETY SPEED PARAMETER	SAFETY SPEED SELECTION SIGNAL		NAME
	SPA _x [G754.0[PMC] / G006.0[DCS]]	SPB _x [G754.4[PMC] / G006.4[DCS]]	
N04372	0	0	Safety speed 1
N04438	1	0	Safety speed 2
N04440	0	1	Safety speed 3
N04442	1	1	Safety speed 4

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION															
S	N03797#0	DCN			Each safety check of Dual Check Safety function for the specified spindle is 0: carried out. / 1: not carried out.															
S	N03797#1	SOV			In the safe speed monitoring function of the dual check safety function, the safety spindle speed limit override signal is 0: Invalid / 1: Valid															
S	N04372			[min. ⁻¹]	Safe speed 1 for each spindle															
S	N04399#1	CTLSTP			When the safe speed over alarm is detected: 0: Performs a free running stop. 1: Performs a controlled stop. (When the motor speed is reduced to the zero-speed detection signal (SST) level or less, excitation is turned off.)															
S	N04438			[min. ⁻¹]	Safe speed 2 for each spindle															
S	N04440			[min. ⁻¹]	Safe speed 3 for each spindle															
S	N04442			[min. ⁻¹]	Safe speed 4 for each spindle															
S	N04448			[min. ⁻¹]	Stop check level															
S	N04460			[°]	Safety speed zero monitoring width for a spindle (SPZR _x G751.4[PMC] / G003.4[DCS] = 1)															
S	N04545#1	MSS			Safe reduced speed check function monitor: 0: the spindle motor speed 1: the spindle speed (Not spindle motor but spindle itself)															
S	N04545#2	SU1			<table><tr><th>SU2</th><th>SU1</th><th>The unit of safety speed</th></tr><tr><td>0</td><td>0</td><td>Unit of 1 min.⁻¹</td></tr><tr><td>0</td><td>1</td><td>Unit of 0.1 min.⁻¹</td></tr><tr><td>1</td><td>0</td><td>Unit of 0.01 min.⁻¹</td></tr><tr><td>1</td><td>1</td><td>This setting is impossible</td></tr></table>	SU2	SU1	The unit of safety speed	0	0	Unit of 1 min. ⁻¹	0	1	Unit of 0.1 min. ⁻¹	1	0	Unit of 0.01 min. ⁻¹	1	1	This setting is impossible
SU2	SU1	The unit of safety speed																		
0	0	Unit of 1 min. ⁻¹																		
0	1	Unit of 0.1 min. ⁻¹																		
1	0	Unit of 0.01 min. ⁻¹																		
1	1	This setting is impossible																		
S	N04545#3	SU2																		
S	N04545#4	SSU			In Safe reduced speed check for spindle of Dual check safety, the unit of speed monitoring of Safe speed for each spindle (the parameters Nos.4372, 4438, 4440 and 4442) and Stop check level (the parameter No.4448) are : 0: Not changed. 1: Regarded as ten times.															

PARAMETER	S1	S2	S3	S4	S5	S6	S7	S8
Spindle name								
N03797#0								
N03797#1								
N04372								
N04399#1								
N04438								
N04440								
N04442								
N04448								
N04460								

PMC signals:

*VLDP_x Safety check request signal [Gn751.0[PMC]/G((path-1)*20+3).0[DCS]]
 0: safety monitor 1st spindle active
 1: safety monitor 1st spindle inactive

SPZR_x [Gn751.4/ G((path-1)*20+3).4] Safety speed zero monitoring request
 0: safety zero speed monitoring is not effective
 1: safety zero speed monitoring is effective

PMC Data:

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
S	Dn004			[min. ⁻¹]	Max. spindle speed
S	Dn008			[min. ⁻¹]	Max. spindle motor speed
S	Dn122			[min. ⁻¹]	Max. spindle set-up speed

n = 0 to 14 (path number -1)

Related alarms:

NBR.	MESSAGE	DESCRIPTION
SP0757	SAFETY SPEED OVER	The CNC CPU detected that during safety monitoring (the safety check request signal (*VLDPs) is 0), the spindle motor speed was greater than the safety speed (parameter No. 4372, 4438, 4440, or 4442) on the n-th spindle. Operate within the safety speed.
SP9016	RAM ERROR	An error occurred in a spindle RAM test. Replace the Spindle amplifier control printed-circuit board.
SP9069	SAFETY SPEED OVER 1	The spindle detected that the speed of the spindle motor exceeded the safety speed (parameter No.4372/No.4438/No.4440 /No.4442, the safety spindle speed limit override signal SPOV1s to SPOV4s) during safety monitoring (the safety check request signal (*VLDPs) is 0).
SP9070	ILLEGAL AXIS DATA	The spindle detected an error during spindle data transfer. Check the connection status of the spindle amplifier. If this alarm is issued after the configuration of spindle amplifiers is changed, set the spindle numbers to the spindle amplifiers (set bit 7 of parameter No. 4541 to 1, then to 0 again, and turn the power to the entire system off).
SP9071	SAFETY PARAMETER ERROR	The spindle detected a safety parameter error. Set the safety parameter again. The following are spindle safety parameters. (No.4372/No.4438 /No.4440/No.4442/No.4448 /No.4545/No.4460/No.4462)
SP9072	MISMATCH RESULT OF MOTOR SPEED CHECK	The spindle detected a mismatch between the CNC result of the motor speed check and the spindle result of it. Replace the Spindle amplifier control printed-circuit board.
SP9074	CPU TEST ERROR	An error occurred in a spindle amplifier CPU test. Replace the Spindle amplifier control printed-circuit board.
SP9075	CRC ERROR	An error occurred in a spindle ROM CRC test. Replace the Spindle amplifier control printed-circuit board.
SP9076	INEXECUTION OF SAFETY FUNCTIONS	Any safety function was not executed. Replace the Spindle amplifier control printed-circuit board.
SP9077	MISMATCH RESULT OF AXIS NUMBER CHECK	The spindle detected a mismatch between the CNC result of the axis number check and the spindle result of it. Replace the Spindle amplifier control printed-circuit board.
SP9078	MISMATCH RESULT OF SAFETY PARAMETER CHECK	The spindle CPU detected a mismatch between the CNC result of the safety parameters check and the spindle result of it. Set the safety parameter again. The following are spindle safety parameters. (No.4372/No.4438/No.4440/No.4442/No.4448/No.4545)
SP9079	INITIAL TEST ERROR	The safety functions at power-up for spindle were not executed. Replace the Spindle amplifier control printed-circuit board.
SP9079	INITIAL TEST ERROR	The safety functions at power-up for spindle were not executed. Replace the Spindle amplifier control printed-circuit board.
SP9135	SAFETY SPEED ZERO ERROR(SP)	The spindle detected that the spindle motor position exceeded the safety speed zero monitoring width (parameter No.4460).
SP9136	MISMATCH RESULT OF SAFETY SPEED ZERO CHECK(SP)	A mismatch between the CNC results of the safety functions and the Spindle results of them occurred. The safety speed zero monitoring should be activated after confirming the stop of a spindle.
SP9148	AXIS NUMBER NOT SET	The spindle number is automatically set. Turn the power to the entire system off. The system detected that no spindle number was set for the spindle amplifier.

Protection of safety parameters

The Dual Check Safety parameters should be protected against modifications.

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N03225				Code for safety parameters Valid range: 0-99999999

Set a code (password) for protecting against modifications to parameters related to Dual Check Safety function (safety parameters). When a code for safety parameters is set other than the value "0", the parameters are locked. In this state, the setting (code) is not displayed but is blank, and safety parameter input is disabled.

KEY	PARAMETER	CODE	VALUE	UNIT	DESCRIPTION
C	N03226				Key for safety parameters Valid range: 0-99999999

When the same value as the code for safety parameters No.3225 is set in this parameter, the key is opened to enable modifications to the safety parameters. The value set in this parameter is not displayed.

When the value other than 0 is set to the code for safety parameters No.3225 and the value is different from this parameter, the key is locked and the safety parameters cannot be modified.

When the power is turned off, the value set in this parameter is cleared to 0. Then the power-off results in the locked state.