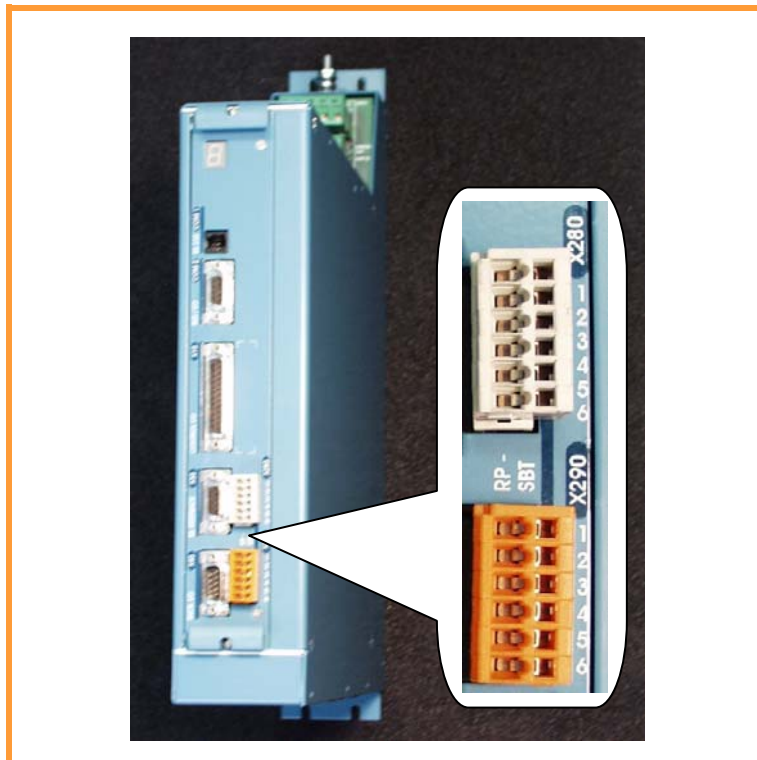


RP_SBT

Option 'Safe Standstill mec. Brake / Thermo'



Further descriptions, that relate to this document:

UL: 07-02-10-01



Product manual 637f

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Made in Germany, 2004

CONTENTS

page

The most important thing first	4
1 General	5
1.1 Intended Combination of Products	5
1.2 Funktion-blocks on Option RP_SBT	5
2 Safe Standstill	6
2.1 General	6
2.1.1 Important Expressions- and Explanations	6
2.1.2 Intended use	7
2.1.3 Authorised and Qualified Personal	7
2.1.4 Advantages when using the Option to perform	7
2.2 Functional Description	8
2.2.1 Pin-Assignment X290:	9
2.3 Commissioning	10
2.3.1 Signal- Chart and Monitoring	10
2.3.2 Configuration.....	12
2.4 Application – Example 1	13
2.4.1 Signal-Chart.....	14
2.5 Application-Example 2	15
2.5.1 Signal Chart	17
2.6 Application Example 3	18
2.6.1 Signal Chart	20
2.6.2 BIAS – Programming „Stop Axis“	21
2.7 Applications using PLC	21
2.8 Application Example 4: Using multiple Drives	22
2.9 Option on Requirement: RC-Combination for K1	23
2.10 Technical Data Safe Standstill.....	24
2.10.1 Installation- and Environment Data	24
3 Mechanical Motor- Brake and PTC-Thermo protection	25
3.1. General	25
3.1.1 Intended Use of Brake-Control	25
3.1.2 Intended Use PTC- Thermo -Protection	25
3.1.3 Block Diagram / Pinning X280.....	25
3.2 Commissioning	26
3.2.1 Configuration Brake-Control	26
3.2.2 Configuration PTC Thermo protection.....	26
3.3. Technical Data	27
4. Maintenance, Repair, Service.....	27
5 Certification	28
6 Modification Record	30

The most important thing first

Thanks for your confidence choosing our product.

These operating instructions present themselves as an overview of the technical data and features.

Please read the operating instructions before operating the product.

If you have any questions, please contact your nearest SSD Drives representative. Improper application of the product in combination with dangerous voltage can lead to injuries.

In addition, damage can also occur to motors or other products.

Therefore please observe our safety precautions strictly.

Safety precautions

We assume that, as an expert, you are familiar with the relevant safety regulations, especially in accordance with VDE 0100, VDE 0113, VDE 0160, EN 50178, the accident prevention regulations of the employers liability insurance company and the DIN regulations and that you are able to use and apply them.

As well, relevant European Directives must be observed.

Depending on the kind of application, additional regulations e.g. UL, DIN are subject to be observed.

If our products are operated in connection with components from other manufacturers, their operating instructions are also subject to be observed strictly.

1 General


1.1 Intended Combination of Products

The Option-Board RP_SBT is designed to be used in combination with 637f- type Servo-Drives.
(Firmware-Version 8.xx)

Intended for Monitoring and Setup : PC-Tools EASYRIDER Version >= 8.19

1.2 Funktion-blocks on Option RP_SBT

RP_SBT is comprising two separate Function blocks:

	<p>The function block on the upper terminal comprises a Relay-output intended to control a mechanical Motor-Brake, as well as a circuit sensing a PTC-thermo sensor for Motor-Protection</p> <p>(Chapter 3)</p>
	<p>The lower terminal block contains all signals required in order to perform the Function 'Safe Standstill'</p> <p>(Chapter 2)</p>

2 Safe Standstill

2.1 General

This document assumes, that the user has fundamental knowledge of Servo-Drives Type 637f and safely machine-construction. This document explains relationships to appropriate regulations and Specifications only in a very brief way.

For further information, usage of appropriate literature is recommended, for example: BIA-Report 6/97 (English Version available and BIA-Report 5/2003 (German only) (Information edited by 'Deutsche Berufsgenossenschaft').

Download: <http://www.hvbg.de/d/bia/pub/rep/index.html>

Definition of Safety-Category 3 acc. To EN 954-1:

If a single fault occurs, the safety function is still maintained. Some, but not all faults are detected. Accumulation of undetected faults can lead to the loss of the safety function.

The remaining rest of risk must be acceptable.

The Machine-Builder is responsible for the Exploration of the safety-category required for specific applications (Risk – Analysis) Please refer to EN954-1 1996, Appendix B.

2.1.1 Important Expressions- and Explanations

Safe Standstill	<p>Safe Standstill defines, that the energy-supply to the Motor is safely removed, acc. to EN1037, Part 4.1. The Motor must not generate forces and possibly dangerous motion. (EN1034, Part 5.3.1.3)</p> <p>There is no requirement to control the standstill-position.</p> <p>In case of probability of influence of external forces, eg. In case of vertical axis and loads tending downwards, additional actions are required to avoid dangerous situations. (eg. Mechanical brakes)</p> <p>These Actions are suitable to comprise Safe Standstill</p> <ul style="list-style-type: none"> - Contactor between Line and Drive-System (Mains- Contactor) - Contactor between Drive and Motor (Motor- Contactor) - Safely locking of Power-Semiconductors inside of the Drive
Safe lock against unintended Start	Safely locking of Power-Semiconductors inside of the Drive

Stopp-Categories acc. to EN 60204-1, Chapter. 9.2.2

Stop-Categorie	Requirement	System-behavior	Remark
0	Stopping Process performed by instantly removed energy-supply to the motor	Uncontrolled Stop	Uncontrolled Stopping defines the stopping-process performed by switching off energy to the motor. Existing mech. Brakes and / or other mechanical Stopping facilities will be used.
1	Stopping Process by maintaining the energy to the motor in order to use this for active braking. Switching-off Energy will be performed, when Movement is over.	Controlled stop	Controlled Stop defined the stopping process by setting the command for electrical motion to zero on receiving the stop-command. Energy is maintained in order to execute this.
2	Stopping Process using energy. Energy is applied to perform Stop	Controlled stop	This category is not covered by functions described in this manual

Safe Standstill

General

2.1.2 Intended use

The Option RP_SBT as part of a Drive type 637fxx-xS5 supports the safety-function 'Safe Standstill' by locking energy and protecting the Drive against unintended Start according to EN954-1, Cat. 3 and EN 1037.

The Stop-Condition must be controlled by machine-control-elements.
Special care has to be taken in case of vertical axis without appropriate mechanical blocking precautions.

According to EN 292; EN 954 und EN 1050 a risk-analysis under responsibility of the machine-builder has to be performed, regarding the full machine-system, including electrical Drives.

2.1.3 Authorised and Qualified Personal

Performing Design, Installation and Commissioning, detailed understanding of this manual is required. As well, Norms and Health-protecting regulations related to the application, must be recognized, Risks and preventive actions or actions in case of emergency have to be known.

2.1.4 Advantages when using the Option to perform Safe Standstill acc. to EN 954-1 Cat 3:

Feature, intended use	Using 637f - Option RP_SBT	Using conventional contactors
Reduced Installation-Effort	Simple installation, pre-certified applications, building drive-groups to be powered by one main-contactor possible	Serial- connection of two safely-designed contactors necessary
usage in production-cycles	Extremely high number of cycles, (usage of low-voltage, low power control-relay) The Status 'Safe Standstill' is performed by using electronical Devices (IGBT's)	Not possible in conventional constructions
High demand on ON/OFF-Cycles and Reliability, high duration		
usage in production-cycles	Drive remains fully powered in terms of Power – and Control-Voltage. Therefore, no power-up-times must be taken in account	When using Power-Contactors for Mains-Supply, long waiting-times must be accepted caused by discharging and charging of DC-Link-Capacitors. When using Power-Contactors in the motor-lines, this can be avoided, but other requirements will appear: a) Usage of Contactors only in current-free-condition (DC current may occur ! Avoid arcs !) b) EMC-compliant cabling may cause additional efforts
High reaction-times, fast stop and restart		
Emergency Stop Function	For Germany: Accepted without use of mechanical Switching-Devices 1)	Usage of mechanical devices mandatory

1) According to the German national foreword of EN 60204-1/11.98, electronically devices are accepted to perform emergency-Stop-Functions assuming the accordance with safety-categories like described in EN954-1 Harmonisation with other nations expected in 2005

Safe Standstill

General

2.1.5 Security-Hints and Restrictions

The Option RP_SBT does not perform galvanic isolation and will not give any precaution against electrical shock. In case of Production-interruptions, Maintenance- or cleaning actions, Mains-voltage has to be removed in a way according to applicable specifications (e.g. Mains Switch) and to be locked against unintended powering-up. (EN 60204-1;5.3)
In case of remaining-risk, exceeding the definitions of EN954-1 Cat 3, the described Option is not applicable.

Rest-Risk: In Case of two failures occurring in the Power-Stage at the same time, there is a chance of a jerk-movement in an angle depending on the Motor- Pole-Pair-number.
(Rotating-Type Motor-Types: 2-poles = 180°, 4-poles = 90°, 6-poles = 60°, 8-poles = 45°;
Linear-Type motors: 180° electrical).

The described Function is serving a function to lock the power – IGBT as well as the conventional ‚ACTIVE’-Input.

Rest-Risk: In case of undetected accumulation of faults, energy stored inside of the DC-Link caps could generate unintended movement.

Rest-Risk: When using Stop-Cat. 1 (EN 60204-1): In Case of occurrence of a failure during the phase of electrical breaking, the drive can idle down or in special cases even accelerate. This behaviour is limited then by the stopping process after a selected safely delay-time.

When using vertical axis, special precautions and risk-estimation to be done to prevent unintended falling-down of loads.

2.2 Functional Description

General:

Current to the motor-windings is controlled by a Set of 6 IGBT – Power Transistors. Three-phase current vectors are generated by Controller– functions and PWM – Logic. Control-Signals to the Power-Stage are galvanic isolated using Opto-Couplers.

Option RP_SBT:

The Terminal – Block X290 is located at the Front side of the Drive.

The Terminals X290.3/4 are connected to a safety-relay (24VDC). The Status of this Relay is indicated by a safely mechanical coupled Feedback-Contact. (X290.5/6)

In case of non-activated relay (0V on X290.3/4), none of the 6 Opto-coupler can be supplied with current by the lack of a Ground-Line. (switched-off). This status is monitored by Feedback-Contact as well as by the Controller, performing additional lock of PWM-Opto-Coupler Control by Software. With 24V DC applied to X290.3/4, controlling the Opto-Couplers and subsequently the IGBT-Power Transistors in possible.

The Feedback-Contact X290.5/6 is used to switch off a mains-contactor in case of malfunction.

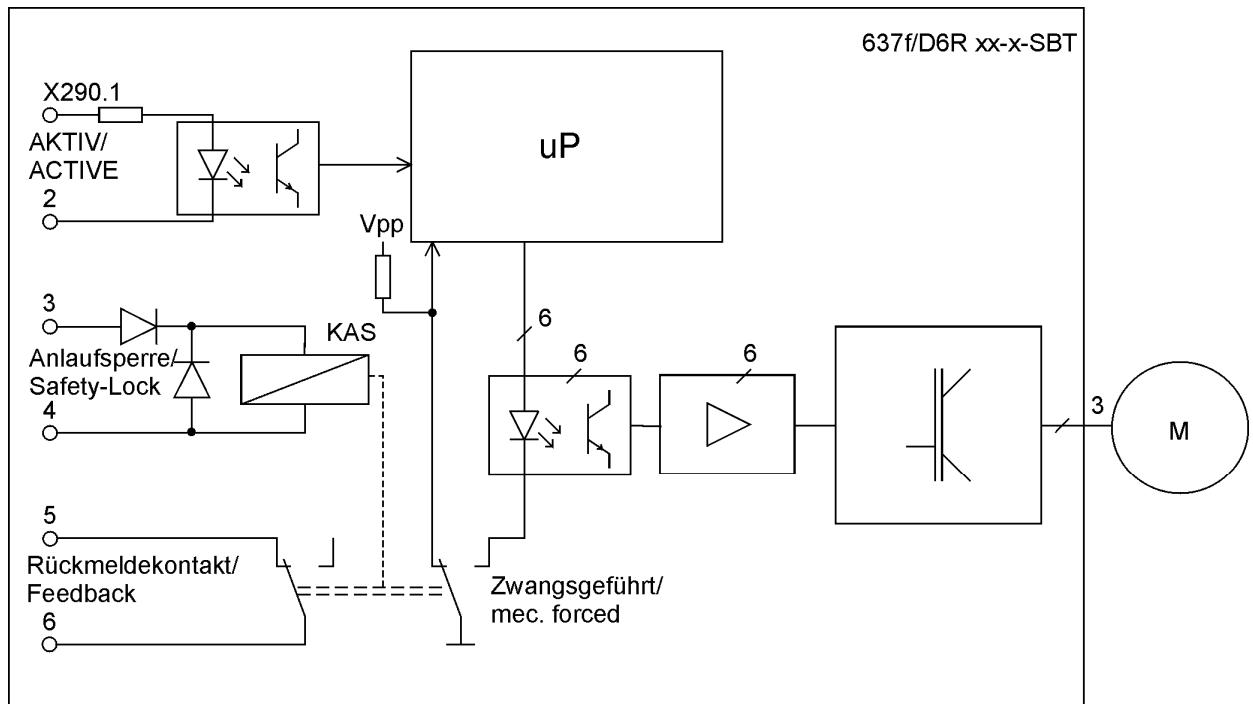
Reason: If the Feedback is not reacting like expected, this indicates a fault in the system.

(Fail-Detection). The failure must be removed before restart is performed.

Safe Standstill

General

Block Diagram:



2.2.1 Pin-Assignment X290:

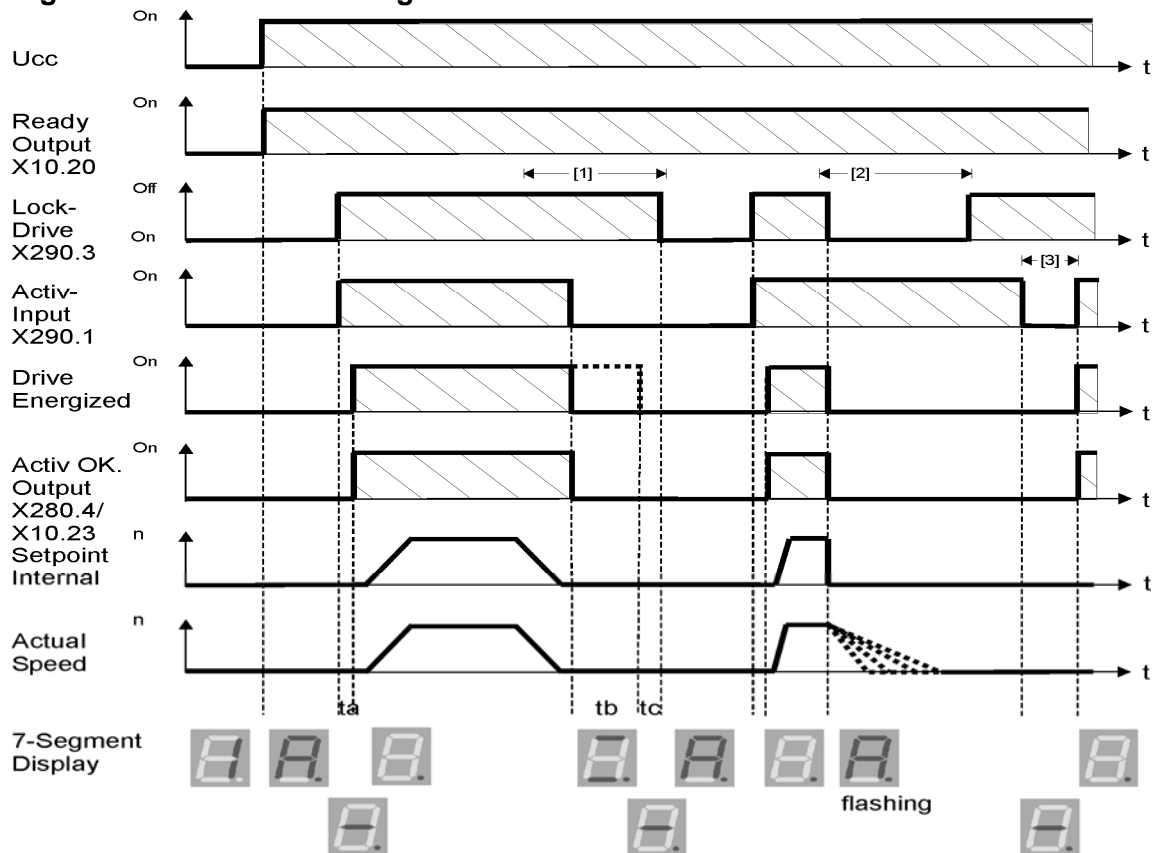
Pin	Description	Remark	Status
1	ACTIVE 1)	OPTO	Digital Input +24V
2	Related to Pin 2		
3	Release safety-lock; Safe Standstill deactive	Relay Coil	Digitale Input +24V
4	Related to Pin 3		
5	Feedback	Relay Contact	Normally closed
6	Related to Pin 5		

- 1) **IMPORTANT NOTE:**
The Access to the Drive-Input Function 'ACTIVE' changes from X10.22 to X290.1 when the Option-Board RP_SBT is inserted! X10.22 may then be used for multiple purpose. (BIAS-programmable)

Safe Standstill

2.3 Commissioning

2.3.1 Signal- Chart and Monitoring



t_a = Delay-time until Drive gets electrical active (app. 40ms)

t_b = Delay-time for braking before inactivating Drive, if configured (Easyrider, 0..800ms)

t_c = Safety-margin

The Activation of the Drive is delayed by 40 mS [t_a] in order to avoid effects by contact-ringing.

Standard-Usage: Controlled Stop (Section [1])

Stopping-Process is started by decelerating the drive to zero speed. When motion is stopped,

The Safe-Standstill-Input must be opened to change the status to 'Safe Standstill'

The Status of 'Safe Standstill' (X290.3/4) and 'ACTIVE' (X290.1/2) is checked by the microcontroller on coincidence. To avoid failure-detection, this check is performed with a time-tolerance of 5 sec.

($t_b + t_c$). Signal-coincidence must not exceed this time-frame.

The Controlled Stopping Process may be performed using those Strategies:

- By usage of external PLC
- By usage of internal PLC (BIAS)
- By configuration and usage of 'Delay time for Brake' (Easyrider)

Function: The internal Speed-Command is set to zero. Drive Deactivation is performed with a time delay [t_b] after setback of 'ACTIVE'. This Time must not exceed the real occurring braking time of the Drive-System.

(Configurable (200..800 mS, PC-Tools Easyrider. Menu Commissioning / Supervision / Delay time for Brake)

High dominance of Safe Stop Function (Section [2])


On activation of Safe Standstill, the ACTIVE-Input is over voted. In case of wrong usage, this is

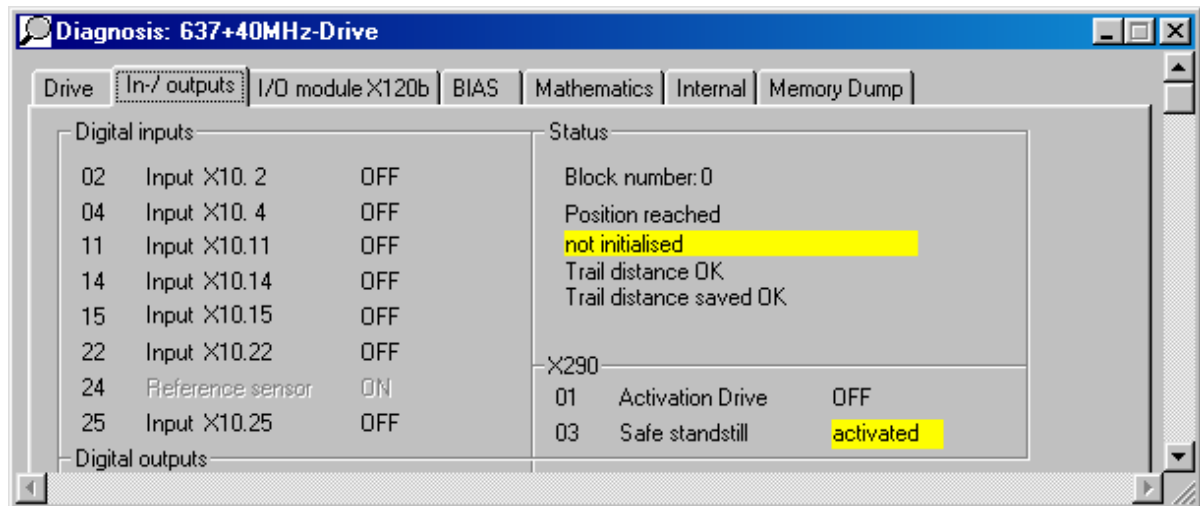
indicated by a flashing on the drive's 7-segment-display.

Safe Standstill

Commissioning

Signal- Chart and Monitoring

Monitoring of Safety-functions is possible by a 7-Segment-Display indicating  if Safe Standstill is active while Drive is ok.
 The Easyrider- Diagnostic- Screen displays all relevant conditions and signals on X290.

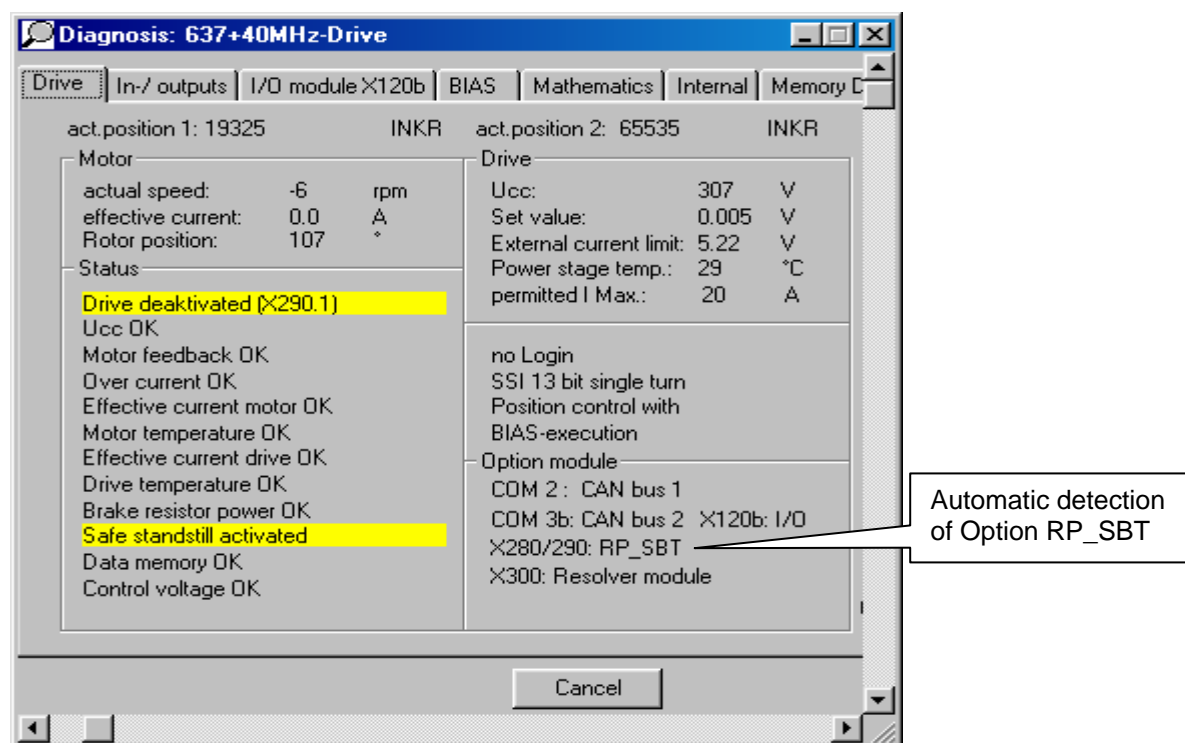


Safe Standstill

Commissioning

2.3.2 Configuration

The function 'Safe Standstill' does not require any configuration.



2.3.3 Check of intended Function

The Function 'Safe Stop' must be checked on:

First Commissioning

- After each change in any relevant Part of the Machine / Application
- After each access to electrical Wiring and Installation
- After each Modification on the Drive
- after long periods of Machine-Standstill and in fixed maintenance periods

All Checks must be performed by qualified personal in respect to all required safety-precautions. Depending on the Application, further Steps may be required. Check-Steps:

1) Remove Voltage at X290.3/4.

Reaction:

a) The Drive will idle to zero speed. (Take care on available space for movement ! Caution when handling vertical axis ! Blocking of mechanics recommended)

b) The Feedback-Contact (X290.5/6) will close

2) Remove (open) Safety-Locker on running motor

Reaction:

a) on Stop-Cat 0: Drive will idle to zero speed immediately

b) on Stop-Cat 1: Drive will actively decelerate and subsequently switch off.

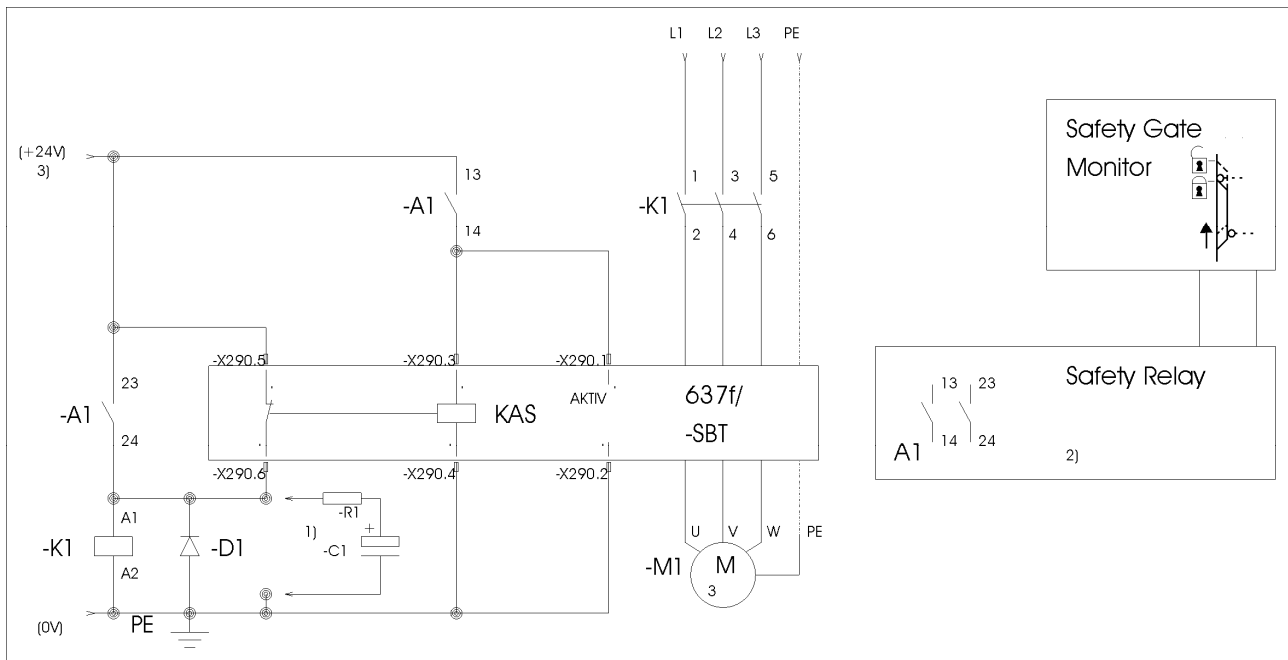
This must be performed without occurrence of situations defined as 'dangerous'.

3) It is recommended to check on simulated failures between feedback-lines (X290.5/6) and peripheral devices, e.G. to disconnect one wire on X290.5/6. All simulated actions must end in disconnecting the mains-contactor.

Safe Standstill

2.4 Application – Example 1

Function	Reaction	Safety-Cat. Acc. to EN954-1	Stop-Cat. Acc. to EN60204
Supervision of Safety-Guard (Opening)	Activation ‚Safe Standstill‘ by Relay KAS (inside of Drive) Main-Contactor K1 remains contacted	3	0
In case of faulty feedback of KAS (X290.5/6)	Main-Contactor K1 will disconnect		



- 1) RC-Combination optional (see Chapter 2.9)
- 2) Position of contacts represent: Guard opened. Safety-Unit used: Type: z.B. Pilz PNOZ X2
- 3) Emergency-Off-Chain or ON/OFF Circuit may be connected here if desired.

Description:

- Safety-Unit (A1) is used performing cross-fail-safe detected installation by two-channelled wiring.
- The Unit A1 is serving the ‚Safe Standstill‘-Input as well as the ACTIVE-Input of the Drive.
- In case of opening the guard, ACTIVE is removed, as well as KAS deactivated ‚Safe Stop‘.
- The feedback-contact X290.5/6 will bypass the open contact of A1.23/24. Thus, K1 remains contacted and Mains will not be removed from the drive.
- In case of malfunction of feedback (X290.5/6), K1 will be inactivated and mains will be disconnected from the Drive.

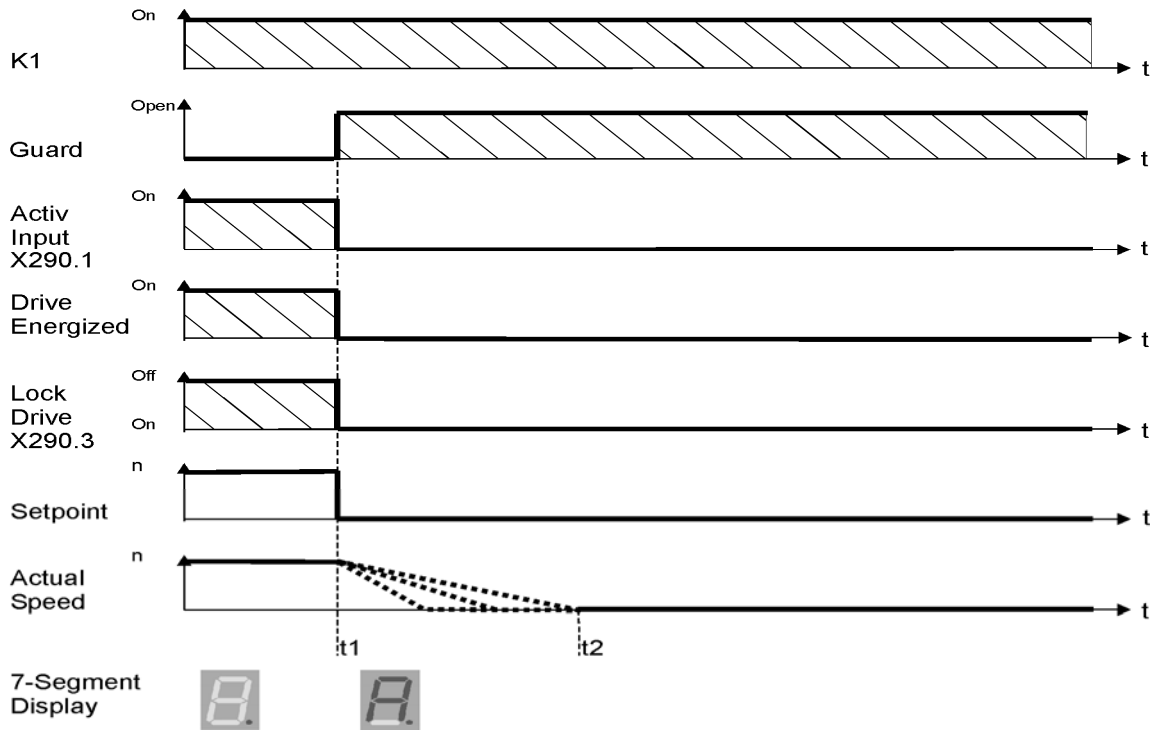
Hints:

- Idling of motor must not generate conditions defined as uncontrolled dangerous.
- Closing the Guard, a acknowledge-action is required before starting again. The starting-circuit comprised by the Safety-Unit A1 may be used for this function.
This may be omitted in cases, when any Risk can be excluded
- For current-load to X290.5/6, please refer to chapter 2.10.

Safe Standstill

Application-Example 1

2.4.1 Signal-Chart



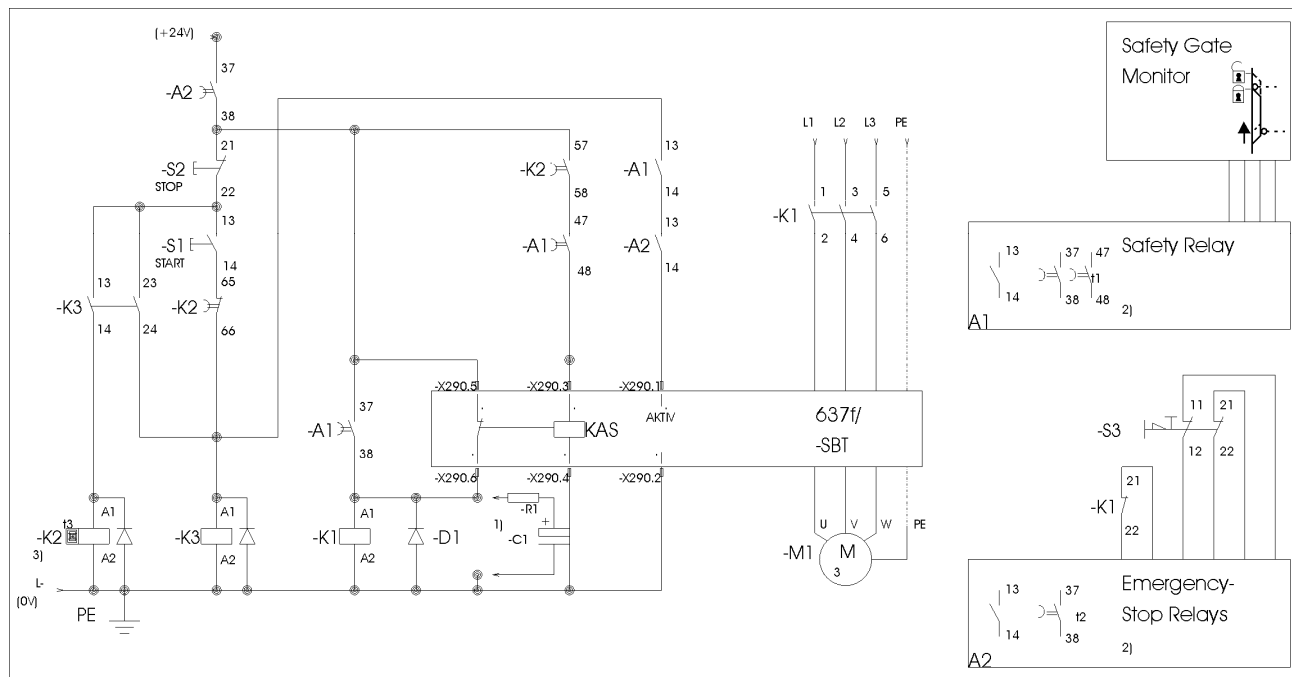
t_1 = Guard opened
 t_2 = uncontrolled idling to zero.

Safe Standstill

2.5 Application-Example 2

Function	Reaction	Safety-Cat. Acc. to EN954-1	Stop-Cat. Acc. to EN60204
Guard (Opening)	Active deceleration with force according to current-limit a), Delay of Time-Relay in A1 c) then activation of 'Safe Standstill' Main-Contactor K1 remains contacted	3	1
Stop-Pushbutton	Active deceleration with force according to current-limit a), then Delay by K2 c) then activation of 'Safe Standstill' Main-Contactor K1 remains contacted	1 b)	1
Emergency Stop	Active deceleration with force according to current-limit a), then Delay by K2 c) then activation of 'Safe Standstill' Main-Contactor K1 will disconnect	3	1
In case of faulty feedback of KAS (X290.5/6)	Main-Contactor K1 will disconnect		

- a) Braking by internal drawing of Speed-Setpoint to Zero Speed, Time-delay until Drive- Deactivation. Configurable (200..800 mS, PC-Tools Easyrider. Menu Commissioning / Supervision / Delay time for Brake)
- b) Cat 3 possible, e.G. by Combination with Emergency-Stop-Unit A2. This Feature is not necessarily required when using this example
- c) Recommended Time-Adjustment: According to realistic Braking-Time plus 50% Margin, 5 Sec. max.



- 1) RC-Combination optional (see Chapter 2.9)
- 2) Position of contacts represent: Guard opened. Safety-Unit used: Type: z.B. Pilz PNOZ X2

Description

- Safety-Units (A1; A2) are used performing cross-fail-safe detected installation by two-channelled wiring.
- Use Contactors with safety-contacts

Function Safe Standstill using Stop-Pushbutton:

- On activation of Pushbutton S2 (Stop), the Signal 'ACTIVE' will be removed. The Axis will brake active according to the configured Time (Delay time for Brake; Easyrider). K3 and K2 are deactivated.
- The Contact K2.57/58 is delayed on deactivation, so, after t3 'Safe Standstill' will be activated.
- Contact K2.65/66 will avoid next start in the case, that K2.57/58 could stick faulty. Unexpected Start is avoided when Guard is opened.

Safe Standstill

Application-Example 2

Function Safe Standstill by Guard:

- In case of opening the guard, 'ACTIVE' is removed.
- Active braking is initiated according to the configured Time (Delay time for brake; Easyrider).
- Contact A1.47/48 (Safety-Unit) opens after delay t1 to activate 'Safe Standstill'. X290.5/6 (Feedback) bypasses the open contact A1.37/38. Thus, K1 remains contacted and Mains will not be removed from the drive.
- In case of malfunction of feedback (X290.5/6), K1 will be inactivated and mains will be disconnected from the Drive.

Function Emergency Stop: (EN 60204 Chapter 9.2.5.4)

- Pushing S3 (Emergency Stop) removes the 'ACTIVE' signal from the Drive. Active braking according to the configured Time (Delay time for brake ; Easyrider) is initiated.
- Contact A2.37/38 (Safety-Unit) opens after delay t2 to activate 'Safe Standstill'. K1 gets inactive in order to disconnect Mains. In case of sticking contacts of K1, this is monitored to Safety-Unit A2 preventing restart in case of sticking contacts.

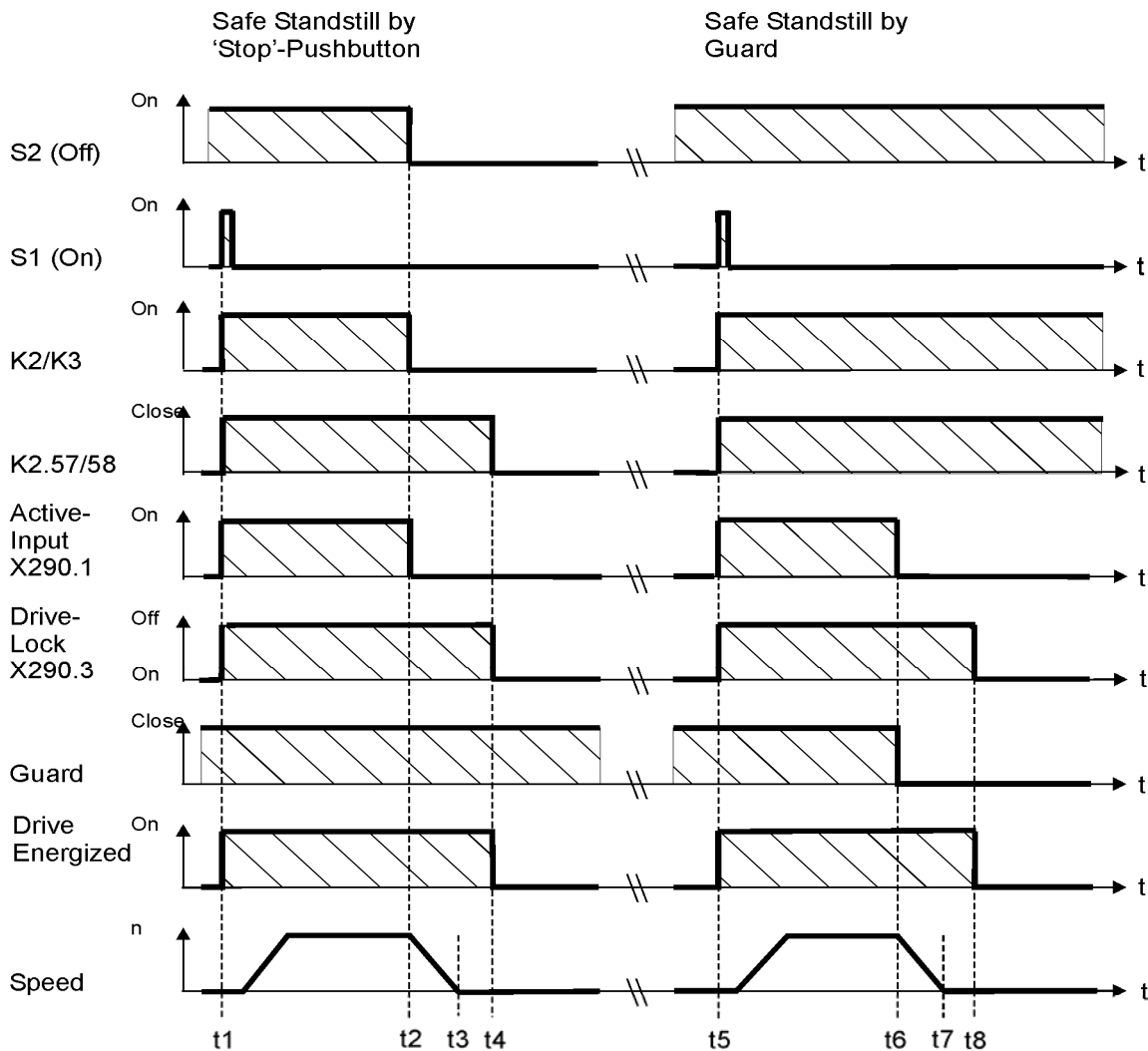
Hints:

- Delay-Adjustment of Safety-units must be greater than the delay time for Drive-deactivation. (200...800mS; PC-Tool EASYRIDER, Menu Commissioning / Configuration / delay time for brake)
- active braking will be performed related to the drive's configured current-limit.
- Closing the Guard, an acknowledge-action is required before starting again. The starting-circuit comprised by the Safety-Unit A1 may be used for this function. This may be omitted in cases, when any Risk can be excluded
- For current-load to X290.5/6, please refer to chapter 2.10.

Safe Stop

Application- Example 2

2.5.1 Signal Chart



7-Segment Display



t1,t5 = Drive activated

t2 = Start of the Braking Procedure by AKTIV-Input (Initiated by 'Stop'-Pushbutton)

t6 = Start of the Braking Procedure by AKTIV-Input (Initiated by Guard)

t3,t7 = Drive Stopped (energized)

t4,t8 = Drive deactivated and Drive Lock activated (Safe Standstill valid).

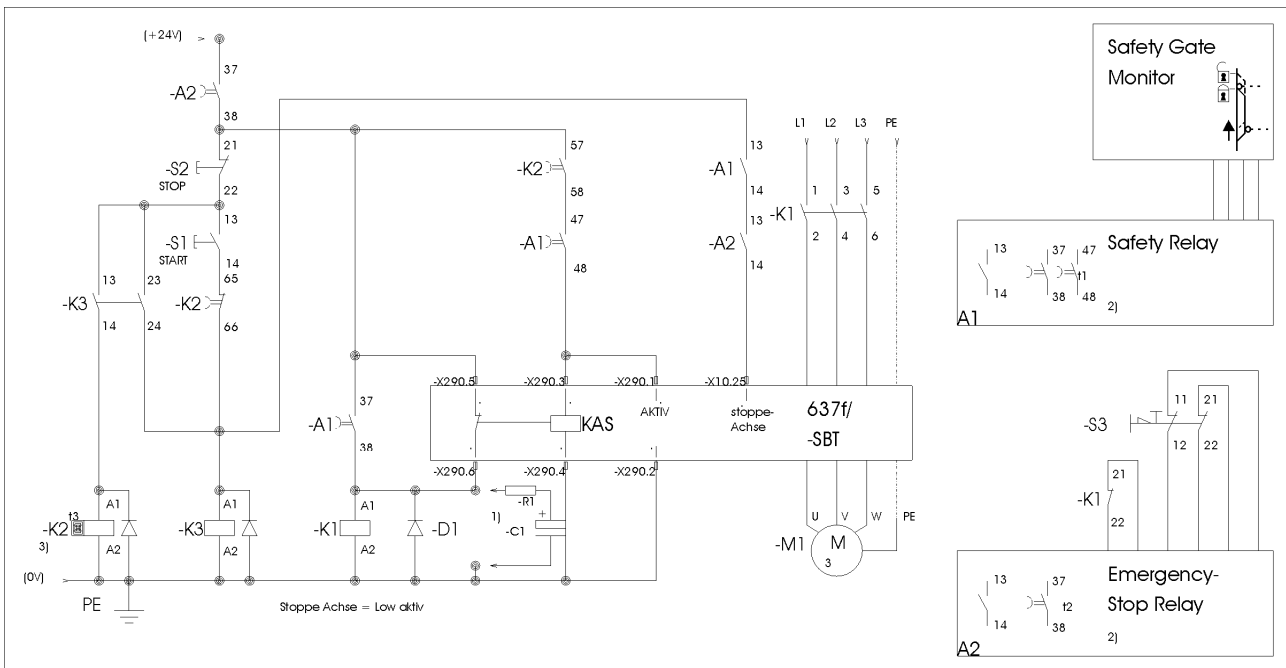
Safe Standstill

2.6 Application Example 3

Function	Reaction	Safety-Cat. Acc. to EN954-1	Stop-Cat. Acc. to EN60204
Guard (Opening)	Active deceleration according to BIAS-deceleration-settings a) Delay of Time-Relay in A1 c) then activation of 'Safe Standstill' Main-Contactor K1 remains contacted	3	1
Stop-Pushbutton	Active deceleration, according to BIAS-deceleration-settings a) Delay by K2 c) then activation of 'Safe Standstill' Main-Contactor K1 remains contacted	1 b)	1
Emergency Stop	Active deceleration with according to BIAS-deceleration-settings a), Delay by K2 c) then activation of 'Safe Standstill' Main-Contactor K1 will disconnect	3	1

In case of faulty feedback of KAS Main-Contactor K1 will disconnect (X290.5/6)

- a) For Programming-Example see Chapter 2.6.2
- b) Cat 3 possible, e.G. by Combination with Emergency-Stop-Unit A2. This Feature is not necessarily required when using this example



1. RC-Combination optional (see Chapter 2.9)
2. Position of contacts represent: Guard opened. Safety-Unit used: Type: z.B. Pilz PNOZ X2

Description

- Safety-Units (A1; A2) are used performing cross-fail-safe detected installation by two-channelled wiring.
- Use Contactors with safety-contacts

Function Safe Standstill using Stop-Pushbutton:

- On activation of Pushbutton S2 (Stop), the Signal 'ACTIVE' will be removed. The Axis will brake active according to the configured Time (Delay time for Brake ; Easyrider). K3 and K2 are deactivated.
- The Contact K2.57/58 is delayed on deactivation, so, after t3 'Safe Standstill' will be activated.
- Contact K2.65/66 will avoid next start in the case, that K2.57/58 could stick faulty. Unexpected Start is avoided when Guard is opened.

Safe Standstill

Application Example 3

Function Safe Standstill by Guard:

- In case of opening the guard, Signal 'STOP AXIS', (X10.25) is removed.
- Active braking is initiated by BIAS - Program.
- Contact A1.47/48 (Safety-Unit) opens after delay t1 to activate 'Safe Standstill'. X290.5/6 (Feedback) bypasses the open contact A1.37/38. Thus, K1 remains contacted and Mains will not be removed from the drive.
- In case of malfunction of feedback (X290.5/6), K1 will be inactivated and mains will be disconnected from the Drive.

Function Emergency Stop: (EN 60204 Chapter 9.2.5.4)

- Pushing S3 (Emergency Stop) removes Signal 'STOP AXIS' (X10.25) from the Drive. active braking according to BIAS – Programmed deceleration is initiated.
- Contact A2.37/38 (Safety-Unit) opens after delay t2 to activate 'Safe Standstill'. K1 gets inactive in order to disconnect Mains. In case of sticking contacts of K1, this is monitored to Safety-Unit A2 preventing restart in case of sticking contacts.

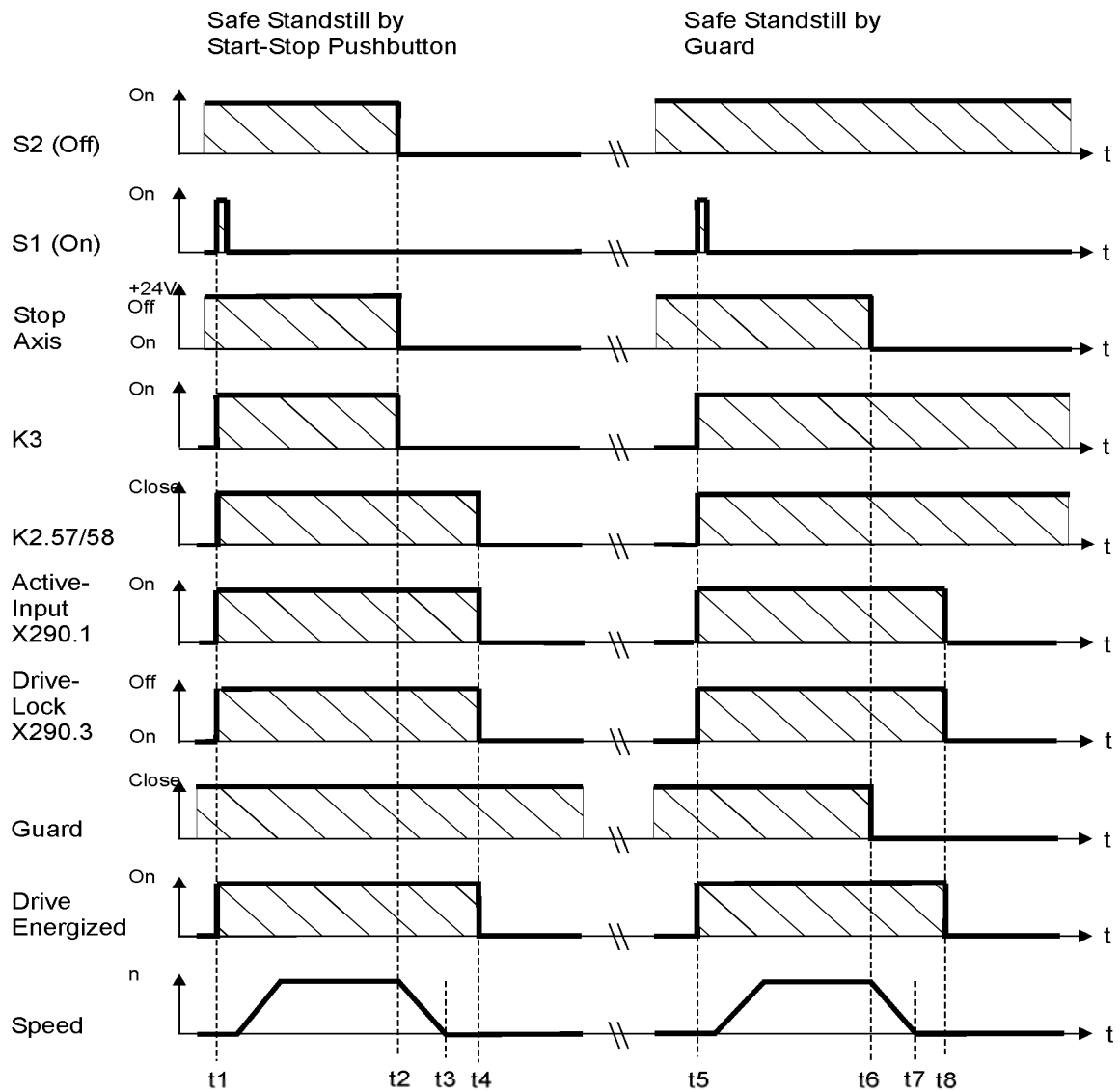
Hints:

- Delay-Adjustment of Safety-units must be longer than the delay time for Drive-deceleration to zero speed.
- Example for BIAS-Programming: See Chapter 2.6.2
- Closing the Guard, an acknowledge-action is required before starting again. The starting-circuit comprised by the Safety-Unit A1 may be used for this function. This may be omitted in cases, when any Risk can be excluded
- For current-load to X290.5/6, please refer to chapter 2.10.

Safe Standstill

Application Example 3

2.6.1 Signal Chart



7-Segment Display



t1,t5 = Drive activated

t2 = Start of the Braking Procedure by Stop Axis (Initiated by 'STOP'-Pushbutton)

t6 = Start of the Braking Procedure by Stop Axis (Initiated by Guard)

t3,t7 = Drive Stopped (energized)

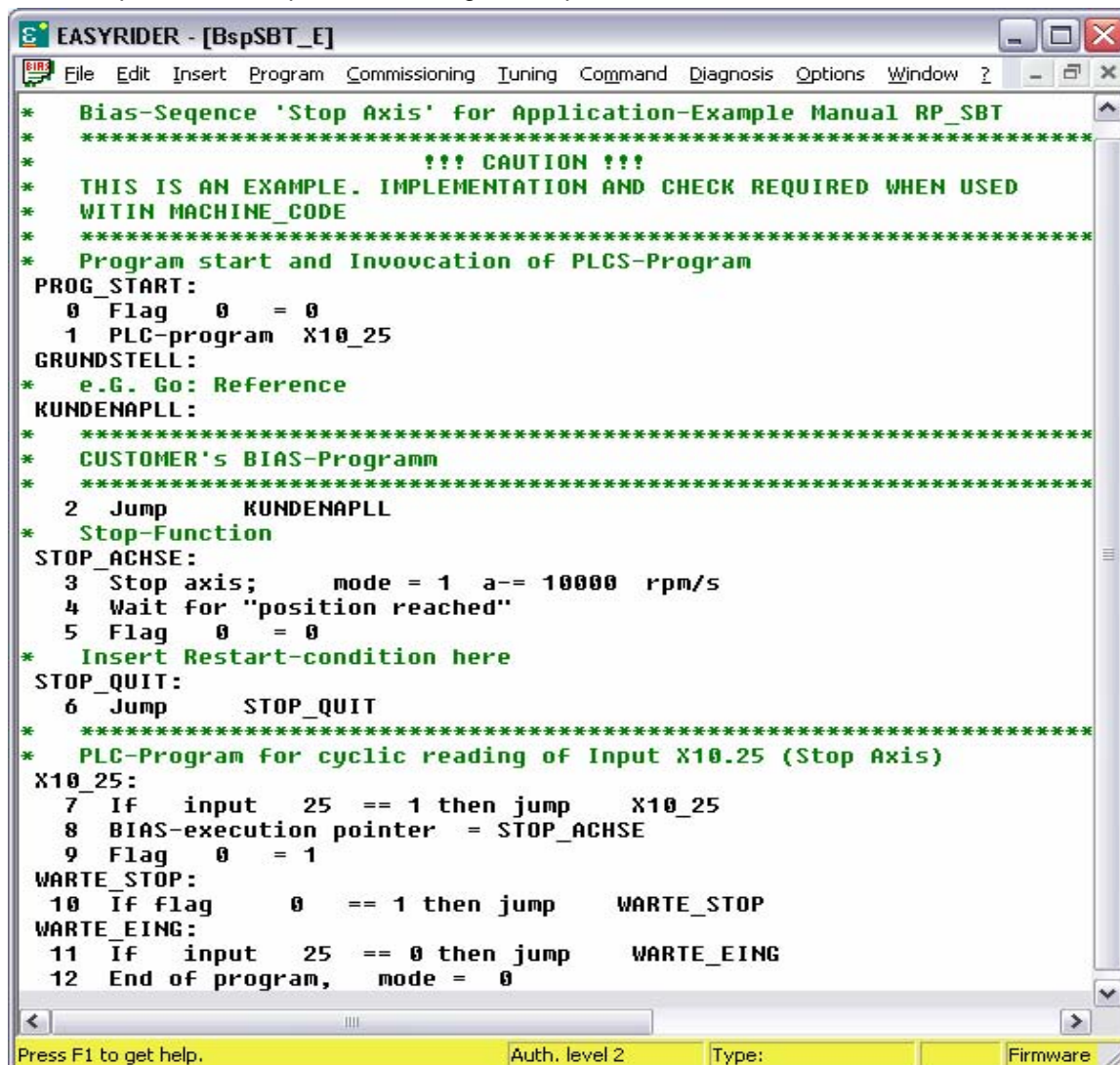
t4,T8 = Drive deactivated and Drive Lock activated (Save Standstill valid).

Safe Standstill

Application Example 3

2.6.2 BIAS – Programming „Stop Axis“

The function ‚Stop Axis‘ can be performed using the sequence below.



```

EASYRIDER - [BspSBT_E]
File Edit Insert Program Commissioning Tuning Command Diagnosis Options Window ?
* Bias-Sequence 'Stop Axis' for Application-Example Manual RP_SBT
* *****
*                ??? CAUTION !!!
* THIS IS AN EXAMPLE. IMPLEMENTATION AND CHECK REQUIRED WHEN USED
* WITIN MACHINE_CODE
* *****
* Program start and Invovcation of PLCs-Program
PROG_START:
  0 Flag  0  = 0
  1 PLC-program X10_25
GRUNDSTELL:
* e.G. Go: Reference
KUNDENAPLL:
* *****
* CUSTOMER's BIAS-Programm
* *****
  2 Jump      KUNDENAPLL
* Stop-Function
STOP_ACHSE:
  3 Stop axis;    mode = 1 a-- 10000 rpm/s
  4 Wait for "position reached"
  5 Flag  0  = 0
* Insert Restart-condition here
STOP_QUIT:
  6 Jump      STOP_QUIT
* *****
* PLC-Program for cyclic reading of Input X10.25 (Stop Axis)
X10_25:
  7 If input  25 == 1 then jump  X10_25
  8 BIAS-execution pointer = STOP_ACHSE
  9 Flag  0  = 1
WARTE_STOP:
 10 If flag   0  == 1 then jump  WARTE_STOP
WARTE_EING:
 11 If input  25 == 0 then jump  WARTE_EING
 12 End of program, mode = 0
  
```

Press F1 to get help. Auth. level 2 Type: Firmware

Requirements:

Operating Mode : 5; Bias-Execution
Assigned Input:: X10.25; related to BIAS-Input 25

2.7 Applications using PLC

The proposed Application-Examples 1....3 may be modified on users responsibility. Safety-relevant functions must be maintained.

PLC-Systems can may be used to evaluate the feedback-signal (X290.5/6) as far as the PLC generates same functionality.

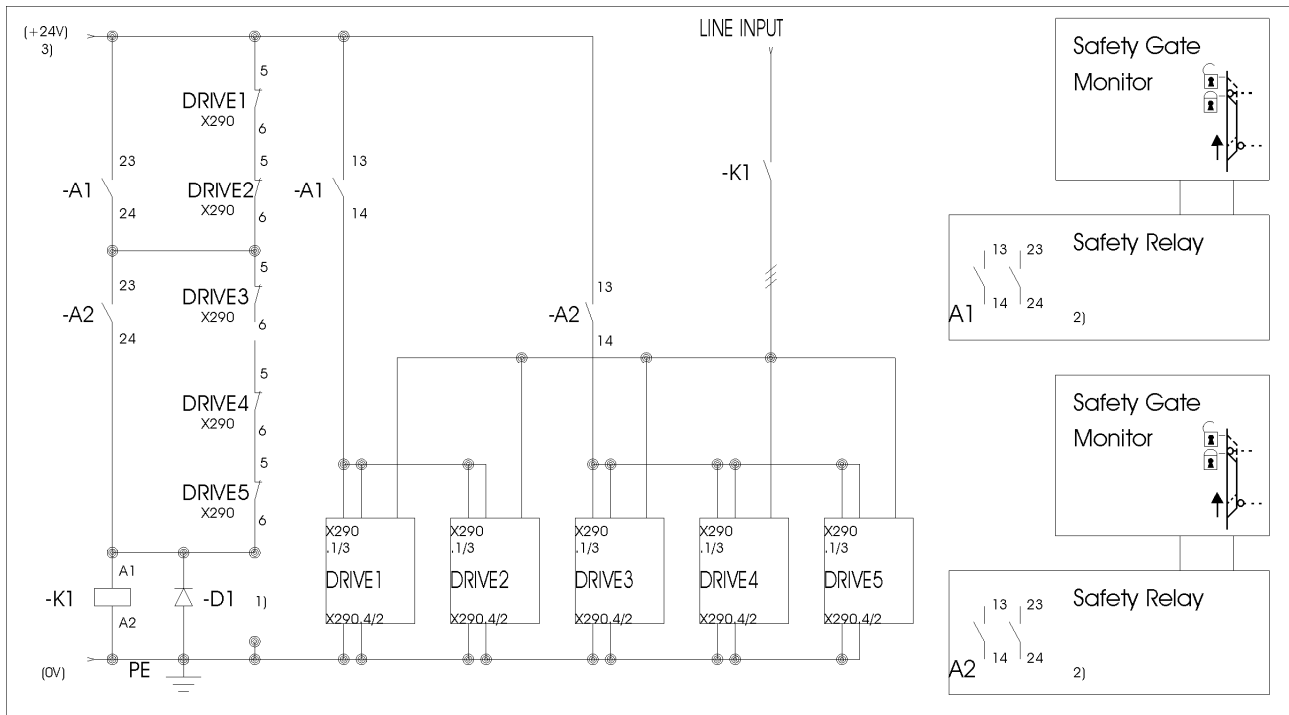
This means in essence:

- Check of Coincidence of ACTIVE-Signal (X290.1/2) and Feedback-Signal (X290.5/6)
- Switching Off the Drive in case of malfunction

Safe Standstill

2.8 Application Example 4: Using multiple Drives

- This Example describes, how to collect multiple Drives to groups and how to connect them to common mains. The User may adapt this example to his particular requirements in order to divide 'Safe Stop' requirements and 'Commissioning' – requirements inside of one working-area.
- The example below is related to Application Example 1. It may be modified to comprise functionality of Application Examples 2 or 3 if required. All hints of these Application Examples must be recognised.



1. Combination optional (see Chapter 2.9)
2. Position of contacts represent: Guard opened. Safety-Unit used: Type: z.B. Pilz PNOZ X2
3. Emergency-Off-Chain or ON/OFF Circuit may be connected here if desired.

Description

Safety-Units (A1; A2) are supervising separate protective areas each. In case of opening one Guard, the Drives in the remaining Safety-Area may stay ACTIVE. Only in case of Malfunction, detected by the chain of Feedback-Contacts (X290.5/6), the Mains-Contactor will disconnect all Drives.

Safe Standstill

2.9 Option on Requirement: RC-Combination for K1

In order to avoid unintended deexcitation of Mains-Contactor K1 in case of X290.5/6 is bypassing, the fallback-time of K1 must be greater than than the closing time of X290.5/6. Normal conditions will comprise a fallback-time of K1 in the range of 30...60 mS (Free-wheel Diode used). The closing-time of KAS (X290.5/6) is in the range of 9 ms, thus, normally no further action is required. In special cases, the fall-back time of K1 can be extended by using an RC-Combination like described below.

Calculation Example:

Values

R_1 = Resistor

C_1 = Capacitor

I_{peak} = max. acceptable inrush-current (max. 3A)

R_{Sp} = Mains-Contactor Coil-Resistance

$U_{min Sp}$ = min. coil excitation voltage before disconnection

Δt = extension of fall-back time-delay

to be evaluated
to be evaluated

= 2A (chosen)

= 60Ohm (from Data)

= 8V (from Data)

= 20ms (chosen)

Step 1: Select Value of Resistor (R_1 min = 8,2 Ohm).

$$R_1 = \frac{24V}{I_{peak}}$$

$$12Ohm = \frac{24V}{2A}$$

Step 2: Calculate Capacitor for selected delay-time

$$C1 = \frac{\Delta t * 2 * \left(\frac{U_{min Sp}^2}{R_{Sp}} + \frac{\left(\frac{24V + U_{min Sp}}{2} \right)^2}{R_1 + R_{Sp}} \right)}{(24V)^2}$$

$$321\mu F = \frac{20ms * 2 * \left(\frac{8V^2}{60Ohm} + \frac{\left(\frac{24V + 8V}{2} \right)^2}{12Ohm + 60Ohm} \right)}{(24V)^2}$$

Result:
 $R1 = 12Ohm$
 $C1 = 330\mu F/40V$

Safe Standstill

2.10 Technical Data Safe Standstill

Technical Data: Plug – On Connector X290	
Type of connector	Female, using CAGE CLAMP-Contacts
Wire Size (flexible type) [mm ²] / [AWG]	0,08 - 1,5 / 28 – 14
Length of isolation strip-off [mm]	7
Tool	Screwdriver 2,5 * 0,4mm
Isolation – Material	PA
Flame Class corresponding to UL94	V0

Technical Data: Energy Lock for Safe Standstill	
ACTIVE-Input X290.1/2	
Nominal Voltage	24V DC
Electrical Data	Low = 0..7V DC oder disconnected High = 15..30V DC Input current at 24VDC = 8mA
Input-Filter / delay	(0→24V) 200us (24→0V) 1000us
Safety-Relay X290.3/4 und 5/6:	
Nominal Coil Voltage at +20°C [V DC]	24 (+18...31,2)
Coil-Resistance at +20°C [Ohm]	750
Contact-Voltage min./max. [V DC]	10 / 30
Contact-Current min./max. [A]	0,01 / 3
Capability DC1, VDE 0660 [V DC/A]	24 / 3
Capability DC13, VDE 0660 [V DC/A]	24 / 1
Fuse to be used acc. to EN60947-5-1, 10/91	10A fast or 6A slow
Electrical Lifetime at AC230V 6A cosφ = 1	>10 ⁵ at 1s ON, 1s OFF
Switching-Frequency max. [(ON-OFF)./s]	10
Excitation / deexcitation delay [ms]	Typical 10 / typical 9
Ringin-time at Feedback X290 5/6 [ms]	Typical 10
Mech. Lifetime [ON-OFF-Cycles]	>10 ⁷
Shock-Proof	10..200Hz; 0,35mm Amplitude; 5g max. IEC 60 068-2-6
Galvanic isolation to other parts of the Drive	Basic Isolation acc. to EN50178

CAUTION:

The minus-connection of the Relay –coil (X290.4) must be connected to PE / GND external
In order to perform protection against Short-Circuits to PE !

2.10.1 Installation- and Environment Data

The Drive must be installed inside a cabinet protected acc. to IP54 at least.
Further, all Data according to the Drive's Manual are applicable (Drive-Manual, Chapter 1.3.2)

3 Mechanical Motor- Brake and PTC-Thermo protection

3.1. General

3.1.1 Intended Use of Brake-Control

The Relay on X280.5/6 is intended to be connected to mechanical Motor-Brakes. The functionality offered is identical to X10.23, but comprises some benefits:

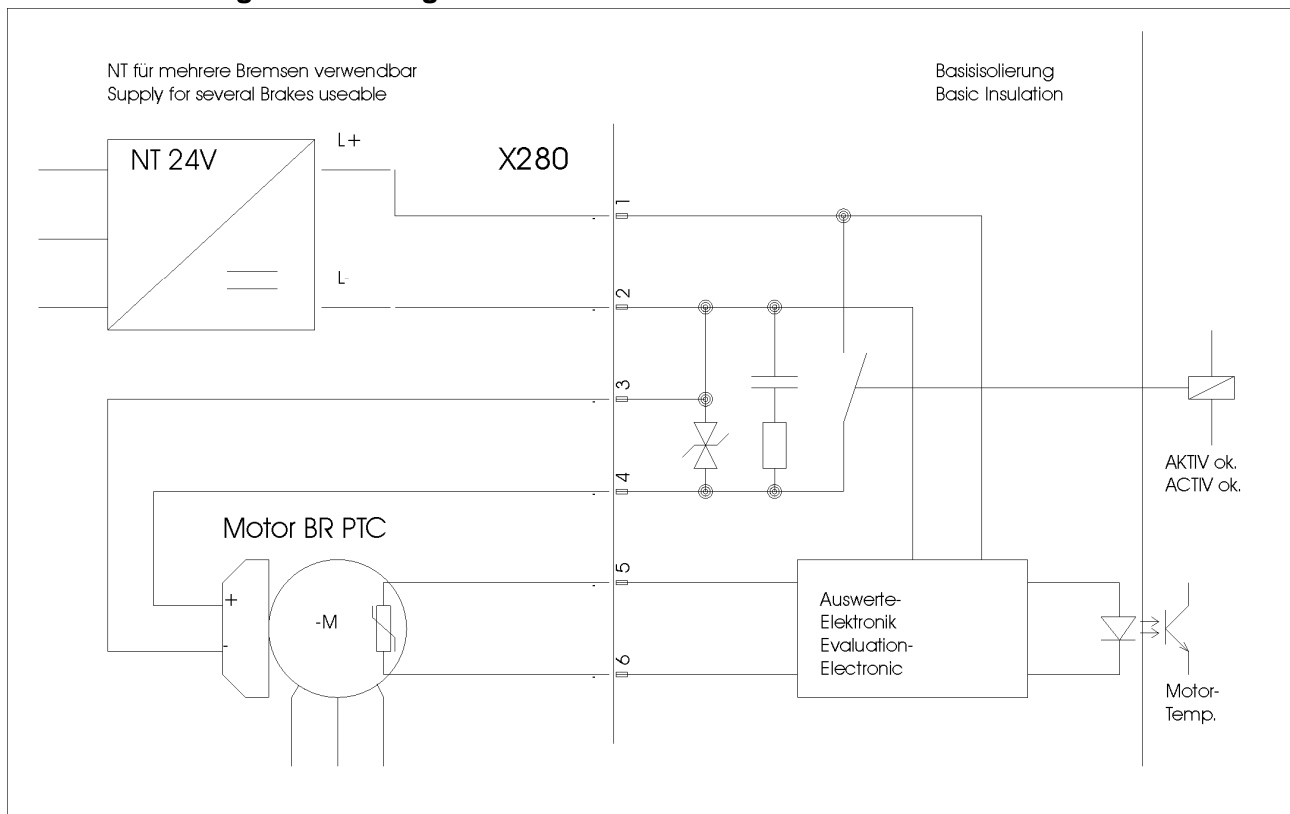
- Improvement of Isolation: Basic Isolation-performance in order to connect mechanical brakes without the use of intermediate relays, while the standard-PELV – Isolation of the Drive is maintained.
(Drive-Manual 637f, Chapter 2.3.2)
- Over voltage-Protection and free-wheel precautions included.
- Rugged and reliable Relay-Type.

3.1.2 Intended Use PTC- Thermo -Protection

The PTC-Connection is intended to sense Motor-Temperature in order to protect the motor. The function is identical to Drive's X30.2/6, but comprises some benefit:

- Improvement of isolation: Basic Isolation-performance in order to connect: PTC-Sensors being in Status of basic-isolation their selves while the standard-PELV – Isolation of the Drive is maintained.

3.1.3 Block Diagram / Pinning X280



Mechanical Motor- Brake and PTC-Thermo protection

General

Pinning X280

Pin	Bezeichnung	Status
1	Supply for Brake and und PTC – Sensor	Input
2	Related to Pin 1	
3	Related to Pin 4; Brake – Connection	
4	Brake-Connection; (ACTIVE OK)	Relay Output
5	PTC	Input
6	PTC	Input

IMPORTANT NOTE:

- The Access to the Drive-Input Function 'ACTIVE' changes from X10.22 to X290.1 when the Option-Board RP_SBT is inserted! X10.22 may then be used for multiple purpose. (BIAS-programmable)
- In case of unused Function ,Safe Standstill, X290 (see chapter. 2.2.1.) has to be connected like below in order to prevent unintended fail-trips
X290.1 connected to X290.3
X290.2 connected to X290.4

3.2 Commissioning

3.2.1 Configuration Brake-Control

The Output X280.3/4 reacts in parallel to X10.23. In order to serve as brake-control, X10.23 must be assigned to the function 'Active OK' (Easyrider / Commissioning / In- Outputs).

3.2.2 Configuration PTC Thermo protection

The configuration does not differ from treatment for X30 .
(Easyrider / Commissioning / Motor / Temperature Sensor)

However, special version of connections require appropriate settings of Jumper JP209

Configuration of Connection	JP209 2-3	JP209 1-3
PTC or NTC at X30 ; RP_SBT unplaced	closed	closed
PTC an X290 ; RP_SBT placed	closed	closed
PTC an X30 ; RP_SBT placed	closed	opened
NTC an X30 ; RP_SBT placed	closed	opened
Default	closed	closed

Brake- Control and PTC Thermo-protection

3.3. Technical Data

Technical Data: Plug – On Connector X290	
Type of connector	Female, using CAGE CLAMP-Contacts
Wire Size (flexible type) [mm ²] / [AWG]	0,08 - 1,5 / 28 – 14
Length of isolation strip-off [mm]	7
Tool	Screwdriver 2,5 * 0,4mm
Isolation – Material	PA
Flame Class corresponding to UL94	V0

Technical Data: Brake, PTC Thermo protection	
Brake X280.3/4 nominal Voltage [VDC]	24
Brake X280.3/4 rated brake-supply voltage (min / max.) [V]	Refer to Motor- Brake- Data
Brake X280.3/4 rated Supply-Current for Brake [A]	Refer to Motor- Brake- Data
Brake X280.3/4 I _{max.} at Output [A]	2
Brake X280.3/4 Rated Number of ON-OFF Cycles	>10 ⁵
Brake: X280.3/4 Voltage at X280.3/4 internal limited to [V]	39
PTC: X280.5/6 Max. supply current max. [mA]	50
PTC: X280.5/6 Measured Volts 100/1640Ω [V]	2,5 / 6,8
PTC: X280.5/6 Threshold [kOhm]	1,2..1,64
Galvanic isolation against other parts of the drive	Basic isolation acc. to EN50178

4. Maintenance, Repair, Service


General

SAFETY-ISSUE !

Installation, Exchange and Repair of the Option Board RP_SBT must be performed at SSD Drives GmbH by special educated personal.

All kinds of modifications or any deviations from this regulation will remove reliability and all kinds of responsibility from SSD Drives GmbH.

5 Certification



Fachausschuss Maschinenbau,
Fertigungssysteme, Stahlbau
Prüf- und Zertifizierungsstelle
im BG-PRÜFZERT

Hauptverband der gewerblichen
Berufsgenossenschaften

Translation **Type Test Certificate** 04001

No. of certificate

Name and address of the holder of the certificate: (customer)	Eurotherm Antriebstechnik GmbH Bereich Servoantriebssysteme Im Sand 14 D 76669 Bad Schönborn-Langenbrücken
Name and address of the manufacturer:	see above

Ref. of customer:	Ref. of Test and Certification Body: 612.17-MFS	Date of Issue: 12.03.2004
-------------------	--	------------------------------

Product designation:	Servo-converter
Type:	637f + Option RP_SBT (Safe standstill)
Intended purpose:	Prevention of unexpected start-up. No prevention of electric shock

Testing based on:	Nr. 1 Grundsätze für die Prüfung und Zertifizierung von Be- und Verarbeitungsmaschinen mit den Anhängen 05.01; DIN EN 60204-1 "Elektrische Ausrüstung von Maschinen-Teil 1: Allgemeine Anforderungen", 11.98; DIN EN 1037 "Sicherheit von Maschinen - Vermeidung von unerwartetem Anlauf" 04.96; DIN EN 954-1 Sicherheit von Maschinen - Sicherheitsbezogene Teile von Steuerungen Teil 1- Allgemeine Gestaltungsleitsätze; Kategorie 3, 03.97
Test report:	3042-2/04
Remarks:	

The type tested complies with the provisions laid down in the directive 98/37/EC (**Machinery**).


The present certificate will become invalid at the latest on:

13.03.2009

Further provisions concerning the validity, the extension of the validity and other conditions are laid down in the Rules of Procedure for Testing and Certification of October 1997.

Fachausschuss Maschinenbau,
Fertigungssysteme, Stahlbau
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PZB10E
12.98



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In any case, the German original shall prevail.

Certification



Fachausschuss Maschinenbau,
Fertigungssysteme, Stahlbau
Prüf- und Zertifizierungsstelle
im BG-PRÜFZERT

Hauptverband der gewerblichen
Berufsgenossenschaften

Translation

Marking Permission

04002

No. of certificate

Name and address of the holder of the certificate: (customer) Eurotherm Antriebstechnik GmbH
Bereich Servoantriebssysteme
Im Sand 14
76669 Bad Schönborn-Langenbrücken

Name and address of the manufacturer: Siehe Auftraggeber

Ref. of customer:

Ref. of Test and Certification Body:
612.17-MFS

Date of Issue:
13.03.2004

Product designation: Servo-converter

Type: 637F + Option RP_SBT (Safe standstill)

Test report: 3042-2/04

Intended purpose: Prevention of unexcepted start up. No prevention of electric shock



The holder of the marking permission is entitled to affix the BG-PRÜFZERT mark shown besides to the products complying with the type tested.
The right to affix the mark shall expire upon expiry of the EC-type test certificate:

04001

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6 Modification Record

Version	Change	Chapter	Date	Name	Remark
V0204	Translation from D-V204		29.03.04	G. Plüddemann	
V0304	SSD Drives		25.10.2004	N. Dreilich	Logos

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