

Drive Warning Concept

Software Change Notification

Version	Date	Editor	Comment
001	2012-10-19	AB	new
002	2012-10-23	MVX	rename from BridgeVoltageWarning to DriveWarningConcept

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1 Summary

This drive firmware introduces a warning concept in addition to the existing concept of errors. This allows an indication, if the drive may be turned on, e.g., if its bridge voltage is valid etc and warning labels that show, why turning on is not possible. This required changing the drive state machine with possible impact on software interfaces to axes.

2 Products affected

Any system setup containing drive hardware with firmware version < 1037 that

- should be upgraded to the actual firmware or
- that requires the new warning features.

Affected hardware

- TS350, TS351, TS150, TS151 revision C
- TSP350 and TSP700 revision A.

3 Description of change

3.1 Behavior in FW<1037

There is no global warning concept. The state 'ReadyToSwitchOn' just indicates that the drive has finished initialization. A potential problem like a missing bridge voltage or an open *SafeTorqueOff* input may be tested using dedicated registers but is not signaled as a state until the user tries to enable.

PowerBridgeVoltage limits are monitored in state 'Operational' only. Missing power or over-voltage in the state 'Operational' leads to switch off the drive with the error message 'BridgeVoltageOutOfRange' and the transition to the state 'FaultPending'. The error must be acknowledged using 'ResetFault', which results in a transition to the state 'ReadyToSwitchOn'. Only after an enable with faulty power, the error message 'BridgeVoltageOutOfRange' comes again.

3.2 Behavior in FW>=1037

PowerBridgeVoltage limits are monitored also in the state 'ReadyToSwitchOn'. The term "BridgeVoltageOutOfRange" is now either an **error** message (in state 'FaultReactionActive' or 'FaultPending') or a **warning** message (in state 'NotReadyToSwitchOn').

Missing power or over-voltage in the state 'ReadyToSwitchOn' leads to the **warning** 'BridgeVoltageOutOfRange' and the transition to the state 'NotReadyToSwitchOn'. Such a warning may not be reset. The drive can not be activated until the power is applied correctly. If the power is correctly applied, the warning disappears automatically and the drive changes to state 'ReadyToSwitchOn'. The drive can then be switched on.

Missing power or over-voltage in the state 'Operational' leads to switch off the drive with the **error** message 'BridgeVoltageOutOfRange' and the transition to

Device State Machine

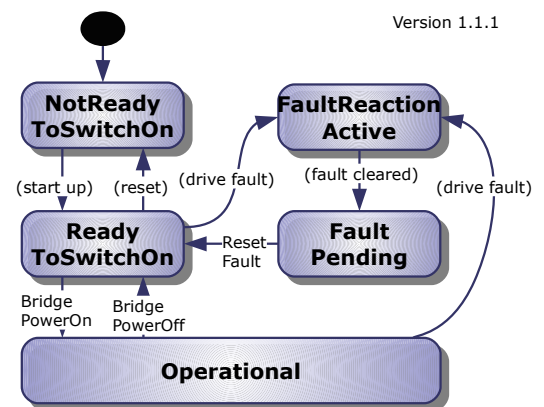


Bild 1: Drive statemachine with FW<1037

Device State Machine

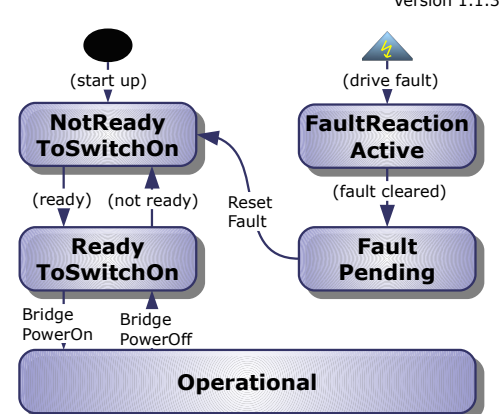


Bild 2: Drive statemachine with FW>=1037

the state '*FaultPending*'. The error must be acknowledged using '*ResetFault*', resulting in a transition to the state '*NotReadyToSwitchOn*'. If power is correctly applied to the drive, it changes automatically to the state '*ReadyToSwitchOn*' in the next cycle and can then be switched on. If the power is still not ok, the drive remains in the state '*NotReadyToSwitchOn*' and in the next cycle, the **warning** '*BridgeVoltage-OutOfRange*' pops up.

A similar behavior was implemented for the safe torque off condition.

4 Consequences of the software change

Typically, an upgrade to the new firmware (Build_FW1037) can be done without any problems. Depending on the implementation of the application the user has to update the TAM software or the PLC library. He also has to expect small SW adaptations in the application. The following consequences are listed for various systems and upgrade scenarios.

4.1 DotNet Application

DotNet applications communicate via TAM with the drives. Thus the version of the TAM must be considered in the scenarios.

Firmware (<FW1037)

- The old TAM (<Tam3.5) doesn't know the state transition to '*NotReadyToSwitchOn*' state caused by a '*ResetFault*'. This can cause problems in an application when it is waiting for the end of a '*ResetFault*' within '*WaitForTermination*'.
- No consequences for the application.

Firmware (>=FW1037), TAM (<TAM3.5)

- The old TAM (<Tam3.5) doesn't know the state transition to '*NotReadyToSwitchOn*' state caused by a '*ResetFault*'. This can cause problems in an application when it is waiting for the end of a '*ResetFault*' within '*WaitForTermination*'.
- TAM should be upgraded to the version TAM3.5 in this case. Minor SW adaptations in the application are needed. Another way is to call *ResetFault()* with a subsequent *Thread.Sleep(10)* instead of calling it with *WaitForTermination()*.
- If the application calls *device.SetOperational()* when the drive is in a '*FaultPending*' state, the method *SetOperational()* will fail and throws an error.
- Call a *device.ResetFault(); Thread.Sleep(10)* before the call of *device.SetOperational()*.
- If the application calls *device.SetOperational()* immediately after *device.ResetFault()* it may happen that the method *SetOperational()* throws an error, if the state is still '*NotReadyToSwitchOn*'.
- Call a *Thread.Sleep(10)* after the call of *device.ResetFault()*.
- The application has to expect not only the state '*ReadyToSwitchOn*' at startup. It must also be aware of state '*NotReadyToSwitchOn*'. A power warning may occur after the start-up and the drive is in the state '*NotReadyToSwitchOn*'.
- If the power warning occurs, the application must generally wait until the condition is

'ReadyToSwitchOn' before it can switch on the drive.

- New is, that there may be an error (more precisely, a *warning*) in the state 'NotReadyToSwitchOn'. The application must recognize this within an entry in the 'DriveError' register if the drive is in the 'NotReadyToSwitchOn' state.

→ Any minor adjustment in the application needed.

Firmware (>=FW1037), TAM (>=TAM3.5)

- The new TAM (>=3.5) knows the state transition to 'NotReadyToSwitchOn' state caused by a 'ResetFault' and can cope with this.
- The application has to expect not only the state 'ReadyToSwitchOn' at startup. It must also be aware of state 'NotReadyToSwitchOn'. A power warning may occur after the start-up and the drive is in the state 'NotReadyToSwitchOn'.
- If the power warning occurs, the application must generally wait until the condition is 'ReadyToSwitchOn' before it can switch on the drive.
- New is, that there may be an error (more precisely, a *warning*) in the state 'NotReadyToSwitchOn'. The application must recognize this within an entry in the 'DriveError' register if the drive is in the 'NotReadyToSwitchOn' state.

→ Any minor adjustment in the application needed.

4.2 PLC application

- The PLC applications communicate directly with the drives. Thus, the TAM version is irrelevant.
- Upgrade to the library Version 2.1.7 if the new PLC functionality 'readyToOperate' is needed.

Firmware (<FW1037)

→ No consequences for the application.

Firmware (>=FW1037)

→ No modifications of the customer PLC code are expected

- A new output "readyToOperate" of TL_AxisSlow and TL_MC_AXIS_REF is TRUE in states "ReadyToSwitchOn" and "Operational". This indicates, that the drive may be switched on or kept on. Wait before enabling until *readyToOperate* to prevent an error of TL_MC_Power.
- If the bridge voltage fails in idle state, the signal "readyToOperate" is FALSE and a corresponding **warning** is signaled (*error*=FALSE,*errorId*=261). This state is left automatically, if the voltage gets valid.
- If the bridge voltage fails in operational state, the signal "readyToOperate" gets FALSE and a corresponding **error** is signaled (*error*=TRUE,*errorId*=268). This state must be acknowledged using TL_AxisSlow.reset or TL_MC_Reset.execute. If the bridge voltage is still not valid, the error changes to the corresponding warning and *readyToOperate* remains FALSE.
- The same applies for the **safe torque off** case. There is a SafeTorqueOff warning (*error*=FALSE, *errorId*=262) and a SafeTorqueOff error (*error*=TRUE, *errorId*=293)