Date: 24 April 2017

The purpose of this document is to provide FAQ for the following issue:

During recent internal development activities, it was discovered that a specific sequence of events could lead to an unintentional motor holding brake disengagement due to corrupted firmware.

The condition may occur from the following sequence of events:

1. Initiate a user firmware file download (via Workbench or Fieldbus)
2. Interrupt the download process (for example by disconnecting the Ethernet cable)
3. The firmware may be corrupted due to the interruption
4. Power cycle the AKD (remove power, re-apply power)
5. If the firmware was corrupted, the AKD will power up using the Backup FPGA firmware

If items 1-5 occur, the motor brake may unexpectedly disengage. The reason for this behavior is an issue in the Backup FPGA firmware.

FAQ:

1. Q: Why is there a Backup FPGA firmware?
   A: The Backup FPGA's purpose is to provide a fallback mechanism to download firmware when the user firmware is corrupted. This Backup FPGA firmware supports only the minimal functionality necessary to for the FPGA (field-programmable gate array) to communicate so the user can flash the AKD with a new user firmware.

2. Q: When is the Backup FPGA firmware used?
   A: The Backup FPGA firmware is used only when the operational FPGA firmware is corrupted. It is NOT used under normal operating conditions including firmware download and boot up.

3. Q: If my system does not have a brake, am I affected by this issue?
   A: No.

4. Q: If my system is always in a safe position during a firmware download, do I need to apply further countermeasures?
   A: If you have properly secured your system such that no motion will occur if the brake disengages during the above sequence, then you do not need to apply further countermeasures.

5. Q: What are possible ways to prevent this issue?
    A: One of the following countermeasures can prevent this issue:
    - Secure the load during firmware download
    - Remove the motor connector from the AKD before starting firmware download (remove power from the AKD before disconnecting any cables!)
    - Upgrade the Backup FPGA firmware on the AKD to version FPB0xx_0602_00_01 or higher

6. Q: What AKDs are affected?
    A: The following model numbers are affected by the bug:
    - AKD-P; AKD-B; AKD-T; AKD-M
    - KC1-B; KC1-M
    - ✓ NOT affected are models beginning with AKD-N, AKD-C

7. Q: Which serial numbers are affected?
    A: The following serial numbers are affected by the bug:
    - B-0901-00001 – B-1714-00255
    - P-0901-00001 – P-1715-00004
    - R-0901-00001 – R-1714-00221
    - T-0901-00001 – T-1715-00000

8. Q: Does the brake disengage while a firmware download is running?
    A: No. The brake will not disengage during a firmware download.
    The brake may disengage during a reboot if the download fails and the user firmware has been corrupted.

9. Q: How do I update the Backup FPGA firmware on my AKD? Is this something I can do myself?
    A: Yes, you can update the Backup FPGA firmware yourself. Instructions to upgrade the Backup FPGA firmware can be found on the Kollmorgen Developers' Network (KDN).

10. Q: What versions will this Backup FPGA upgrade apply to?
    A: All Backup FPGA firmware versions FPB0xx_0300_00_00 through FPB0xx_0602.00.01. 0300_00_00 was released in March 2012; 0602_00_01 was released 10 April 2017. Question 11 explains how to discover what version the customer has.

11. Q: How can I figure out the current version of my Backup FPGA firmware?
    A: Connect to the AKD. Go to terminal view. Enter the command "DRV.INFO". In the section FPGA, you can read the Backup FPGA firmware version.
    For example:

```
FPGA
Version              : FP0006_0602_00_00
Operational image    : FP0006_0602_00_00
Resident image       : FPB006_0602_00_01
Size                 : 45
```

The version for the Backup FPGA firmware can be found under "Resident image".
The coding is as follows: FPB0xx_yyyy_yy_yy
, where "x" represents a certain type
And "y" represents the version number. In this example the version is 0602_00_01.

12. Q: If I upgrade the Backup FPGA firmware, will this influence the AKD's behavior?
    A: No. The Backup FPGA firmware is not used under normal operating conditions. It is not loaded and therefore not part of the main AKD functionality.

13. Q: Will my firmware be tainted when updating the Backup FPGA firmware?
    A: No. The Backup FPGA firmware is not part of the main AKD firmware and is not used under normal operating conditions.

14. Q: Where was this problem found?
    A: It was found in a Kollmorgen laboratory during product development. There are no known incidents in the field.

15. Q: Can a firmware download with a standard beta or production release fix the issue?
    A: No. The Backup FPGA firmware is not part of the standard beta or production release of operational firmware. The Backup FPGA firmware is programmed separately, and requires special files and process. The files and process are listed on KDN.
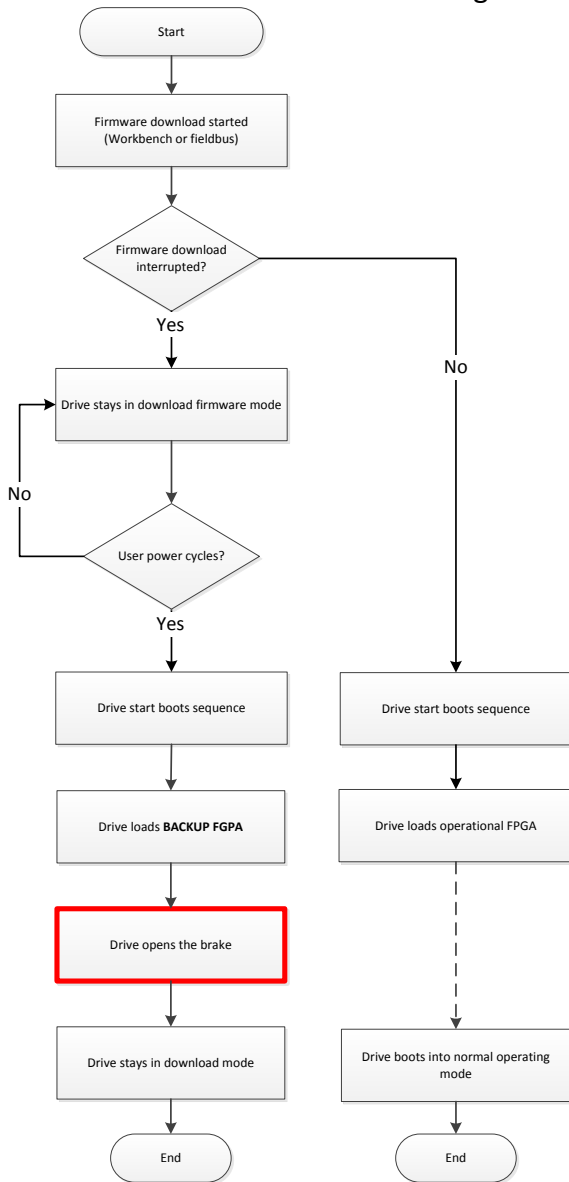
16. Q: Can the brake disengage unexpectedly when a firmware download was successful?
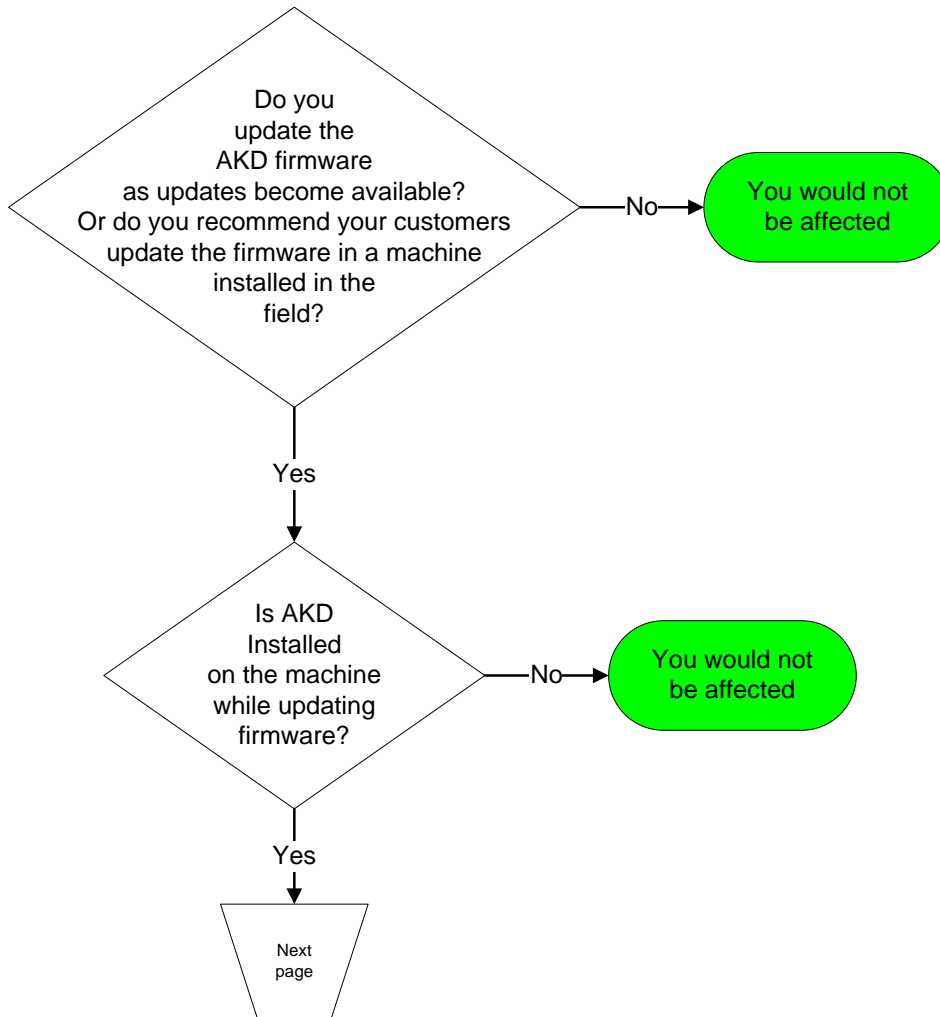   A: No.

17. Q: If I update the Backup FPGA firmware, can the problem occur that the brake disengages after updating?
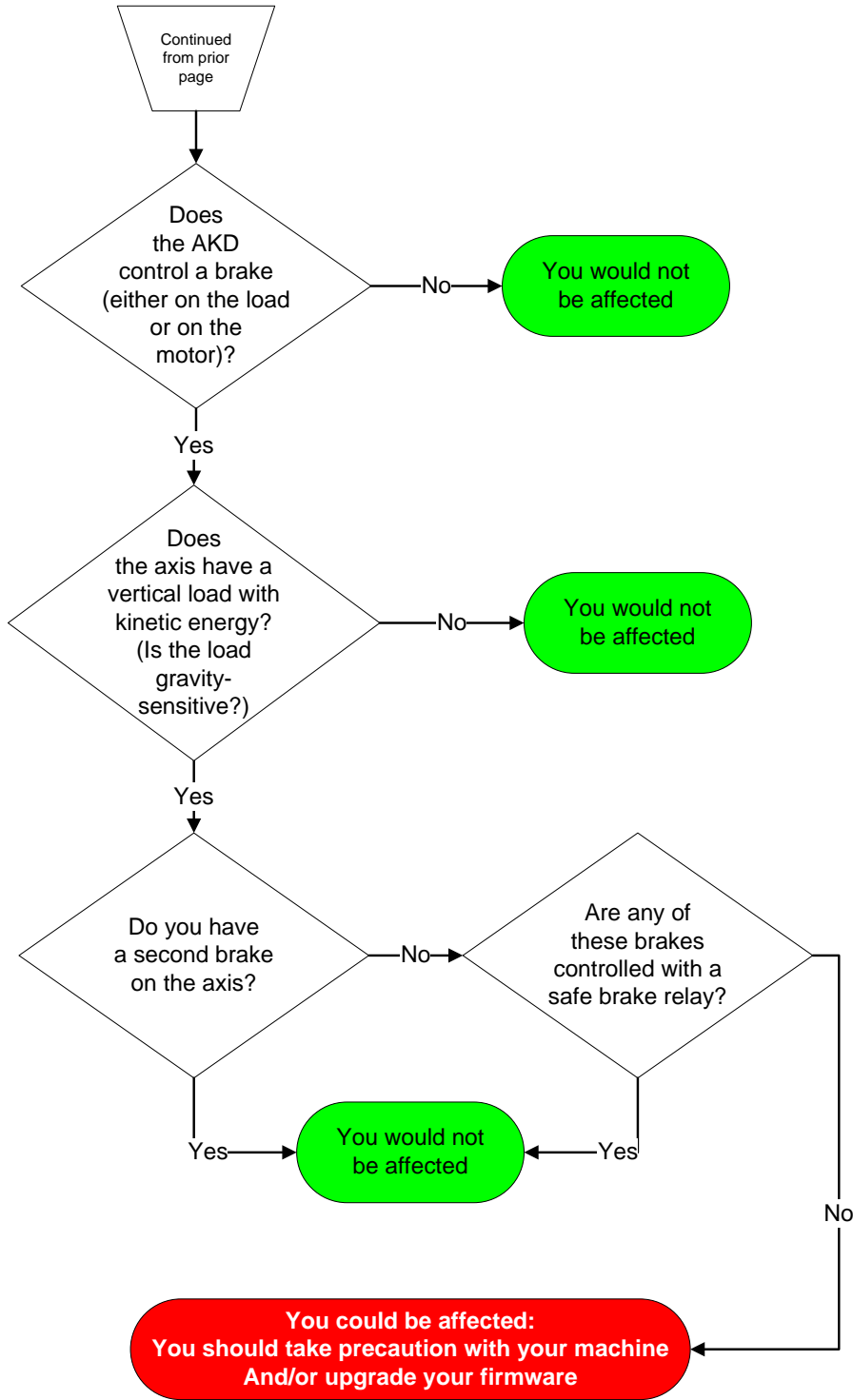   A: No. The updated Backup FPGA firmware (FB0xx_0602_00_01) will behave as expected.

18. The sequence of events leading to possible brake disengagement is described in this flow chart? The box marked in red shows the wrong behavior due the fault condition.

```
                          ┌──────────┐
                          │  Start   │
                          └────┬─────┘
                               │
                  ┌────────────┴────────────┐
                  │ Firmware download started│
                  │ (Workbench or fieldbus)  │
                  └────────────┬────────────┘
                               │
                          ◇ Firmware download
                            interrupted? ───────────────┐
                               │                        │
                             Yes                        No
                               │                        │
              ┌────────────────┴──────────┐             │
              │ Drive stays in download    │            │
         ┌───▶│ firmware mode              │            │
         │    └────────────┬──────────────┘            │
        No                 │                            │
         │           ◇ User power cycles?               │
         │                 │                            │
         └─────────────────┤                            │
                         Yes                            │
                           │                            │
              ┌────────────┴──────────┐   ┌─────────────┴──────────┐
              │ Drive start boots      │   │ Drive start boots      │
              │ sequence               │   │ sequence               │
              └────────────┬──────────┘   └─────────────┬──────────┘
                           │                            │
              ┌────────────┴──────────┐   ┌─────────────┴──────────┐
              │ Drive loads BACKUP FGPA│   │ Drive loads operational│
              │                        │   │ FPGA                   │
              └────────────┬──────────┘   └─────────────┬──────────┘
                           │                            ┆
              ┌────────────┴──────────┐                 ┆
              │ Drive opens the brake  │ (red box)       ┆
              └────────────┬──────────┘   ┌─────────────┴──────────┐
                           │              │ Drive boots into normal │
              ┌────────────┴──────────┐   │ operating mode          │
              │ Drive stays in         │   └─────────────┬──────────┘
              │ download mode          │                 │
              └────────────┬──────────┘           ┌──────┴─────┐
                           │                       │    End     │
                    ┌──────┴─────┐                 └────────────┘
                    │    End     │
                    └────────────┘
```

19. The following flowchart will guide you to help the customer determine whether he is affected by the Backup FPGA firmware. If they are, please direct them to KDN to download the new files and instructions.

Do you
update the
AKD firmware
as updates become available?
Or do you recommend your customers
update the firmware in a machine
installed in the
field?

—No→ You would not be affected

Yes

Is AKD
Installed
on the machine
while updating
firmware?

—No→ You would not be affected

Yes

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Does the AKD control a brake (either on the load or on the motor)?

No → You would not be affected

Yes

Does the axis have a vertical load with kinetic energy? (Is the load gravity-sensitive?)

No → You would not be affected

Yes

Do you have a second brake on the axis?

No → **Are any of these brakes controlled with a safe brake relay?**

Yes → You would not be affected ← Yes

No

**You could be affected:
You should take precaution with your machine
And/or upgrade your firmware**

20. Q: Should I update my AKD (operational) firmware and Workbench while I am updating the Backup FPGA firmware?
A: Probably not. If you are an end user with an AKD working just fine in the field, we suggest you leave it alone.
If you are an OEM, and you think you might want access to the latest features, then you may want the latest (operational) firmware and Workbench. If you do decide to update the (operational) firmware and corresponding Workbench, please **update your Backup FPGA firmware first**. Make sure the drive accepted the updates and has the latest Backup FPGA firmware… Then, if you wish to proceed with updating the (operational) firmware and corresponding WorkBench, feel free to do so. All of the necessary files are on KDN.

21. Q: What does FPGA stand for?
A: Field Programmable Gate Array