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1 New HIMax Operating System Release V5.x

1.1 Operating System Versions for the Various Modules

V5.x includes the following operating system versions:

- V5.14 for processor modules: HIMaxCPU_HA1_BS
- V5.18 for communication modules: HIMaxCOM_HA2_BS
- V5.10 for I/O modules SIL 3: HIMaxIO_HA1_BS
- V5.10 for I/O modules SIL 3, SOE, counter, X-HART and X-MIO: HIMaxIO_HA3_BS
- V5.16 for I/O modules SIL 1 and NonSIL: HIMaxIO_HA2_BS
- V4.20 for system bus modules: HIMaxSB_HA2_BS

1.2 Overview

This document describes the improvements and new functions of V5.x compared to the previous version:

- Chapter 2 describes the new functions of V5.x.

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- Chapters 3 and 4 specify the improvements and provides information on the problems resolved in previous versions.
- Chapter 5 specifies the current restrictions.
- Chapters 6 and 7 describe the procedures to migrate from the previous version.

1.3 Compatibility

V5.x supports all the functions of V4.x.

I/O modules, system bus modules and communication modules can be operated within a system using different operating system releases (V2.x, V3.x V4.x and V5.x).

2 New Features of V5.x

V5.x contains the following new functions:

2.1 New I/O modules

- | | |
|---------------------|---|
| X-MIO 7/6 01 | Overspeed trip module (3 counter inputs, 4 digital inputs, 6 digital outputs, SIL 3, non-safety-related relay output) |
| X-HART 32 01 | HART communication module (32 channels, HART filtering and HART deactivation, SIL 3) |

2.2 HART Functionality

To provide support for HART functionality, HIMax V5.x and higher includes:

- The new module X-HART 32 01
- The HART over IP protocol
This protocol ensures the functionality of a HART multiplexer at the Ethernet interface of a X-COM 01 communication module. The X-COM 01 communicates with the X-HART 32 01 modules via the system bus.
- To upgrade the HIMax system to a later point in time, a X-COM 01 module can be added by performing a reload or the HART over IP protocol can be added to a configured X-COM by performing a cold reload
- The X-HART 32 01 modules within the system are handled as I/O modules and are completely reload capable.

2.3 The New System Variable *SB Essential Information*

This system variable provides the status information details on the responsible system bus modules in the following format:

- 0: CPU modules running in system operation are organized by two responsible X-SB 01 modules.
- 1: CPU modules running in system operation are primarily organized by the responsible X-SB 01 module (rack 0, slot 1) on system bus A. The module must not be removed or system operation is stopped!
- 2: CPU modules running in system operation are primarily organized by the responsible X-SB 01 module on system bus B. The module must not be removed or system operation is stopped!

3 Improvements of V5.x Compared to V4.x

V5.x includes the following improvements:

3.1 Functions of the I/O Modules

- 1 Line diagnosis tests performed to multiple output modules within a base plate caused sporadic error messages
In the previous version, if numerous digital output modules with activated line monitoring were located within a base plate, line diagnosis tests caused sporadic error messages, and potentially, the Error LED of the modules to blink. In V5.10, the test is distributed onto multiple output module cycles to ensure that a maximum of 32 channels are simultaneously tested. [HE19862, HE15423]
- 2 An open-circuit in X-AI 16 51 does not cause the module to shut down.
With X-AI 16 51, an open-circuit present in a channel for longer than 24 hours caused the module to shut down.
This fault has been eliminated in the HIMax X-AI 16 51 OS V5.16 and higher. [HE22339]

3.2 System Functions

- 1 Safety times can be modified during the reload phase Clean-up
With X-CPU 01 V5.14 and higher, the parameters *Safety Time*, *Watchdog Time*, *Target Cycle Time* and *Target Cycle Time Mode* can be set online, even during a reload clean-up phase. The diagnostic entry concerning the reload termination occurs now at reload end, after the FS Clean-up. [HE20738]
- 2 Reload with extended cycle for target cycle time modes *Fixed-tolerant* and *Dynamic-tolerant*
In the previous version, a reload requiring longer than the configured target cycle time was rejected, even in the tolerant target cycle time mode. This problem has been eliminated in V5.14. In the tolerant mode of the current version, every 5th cycle can be increased over the configured target cycle time. The reload process has thus more time available and extensive reload changes can be performed.
Note: The safety time configured for the HIMax system is absolutely maintained, even during the reload process.
[HE20388]
- 3 In a HIMax system with X-CPU 01 version 5.14, a user with the highest rights (Read and Operate) can log in using the Read access right. [HE21477]

3.3 Communication

- 1 Non configured Modbus slave protocol displays the state in the online view
With X-COM 01 V5.10 and higher, the INVALID CONFIG state is displayed in the SILworX Control Panel if the Modbus slave protocol is not configured. [HE20933]
- 2 Simultaneous transmission and processing of SNTP messages
With V5.14 and higher, SNTP messages from a communication module operating as SNTP client are no longer discarded by the processor module if the previous SNTP message has not been completely processed. The diagnostic message "Short-term PGS: System internal message of system.rack.slot=xxx/yy/zz discarded: Receive limit 1 exceeded" no longer exists. [HE20744]

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- 3 NSIP with no output data does not cause the system to stop operation
In the previous version, it could happen that the processor module could stopped operation after synchronization, in coincidence with the following circumstances:
 - A non-safety-related communication protocol (NSIP) is set-up
 - This protocol has no output data
 - The protocol is configured via a communication module that is not plugged in to the base plate.In V5.14, the processor module performs synchronization without errors, even if a communication protocol with no output data is configured. [HE19533]
- 4 With X-COM 01 V5.10, the communication module Ethernet switch is activated, even if the system ID was changed and the supply voltage was subsequently switched off and on again.
In the previous versions, the communication modules no longer activated their Ethernet switch after the following sequence of events:
 - a Change of the system ID
 - b Switching the supply voltage off and on again[HE22137]
- 5 Improved system bus communication with X-SB 01 OS V4.20 and higher. Packets are no longer lost in HIMax system configurations, in which multiple X-COM 01 and large process data volume are used for non-safety-related communication (e.g., Modbus slave protocols with 10 000 or more register variables).
External communication via the X-COM 01 module is free from interferences, even with large process data volume. [HE22589]

3.4 ComUserTask with X-COM 01 V5.10

- 1 After a reload, the ComUserTask can be loaded and started once again
If an error causes the ComUserTask to terminate and a reload is subsequently performed, it is possible to restart the ComUserTask.
In the previous versions, the restart was aborted with an error message. [HE20578]
- 2 The state WORKING is displayed while the ComUserTask is being restarted
If the ComUserTask is terminated due to an error and then restarted, the PADT Control Panel displays the state WORKING during the starting phase.
The previous versions did not display this state. [HE21393]
- 3 The toggle mode for controlling the ComUserTask state can now function
In the previous version, this toggle mode did not function. [HE20863, HE20862]
- 4 Calling *CUL_Socket_Accept* is possible with *plpAddr=0* and *pTcpPort!=0*
The interface method *dword CUL_SocketAccept(dword serverSocket, udword *plpAddr, uword *pTcpPort)* can now also be called with the parameters *plpAddr=0* and *pTcpPort!=0*.
In the previous version, such a call caused the communication module to reboot. [HE21239]
- 5 Memory is released when the ComUserTask is terminated
If the ComUserTask terminates while a TCP/UDP socket interface callback function terminates, the used memory is released.
In the previous version, the memory was not released, which could cause the communication module to reboot due to lack of memory. [HE21273]
- 6 Sending a message before a previous message is completely sent
If the ComUserTask terminates while a TCP/UDP socket interface callback function is being processed, the used memory is released.

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In the current version, a message can be sent without errors before the previous sending procedure is completed. [HE21939]

The idle time for identifying the telegram boundaries is set to 5 characters. While sending, the communication module automatically ensures that the idle times between telegrams are observed.

A communication partner sending multiple telegrams to a ComUserTask must insert at least 5 idle characters between these telegrams. Otherwise, the ComUserTask identifies multiple telegrams as being one.

If the ComUserTask consecutively sends multiple telegrams, the user interface can save one telegram until the previous telegram has been completely processed, and then send it. Each telegram immediately sent by the ComUserTask is discarded with the error code CUL_WOULDBLOCK.

7 Proper evaluation of telegram errors

During serial communication between HIMax X-COM 01 and ComUserTask, the communication driver properly evaluates telegram errors as frame or parity errors. [HE21984]

4 Improvements of X-COM 01 V5.18 Compared to V5.10

Some improvements are related to the restriction described in Chapter 5.3, which no longer applies. Further improvements include:

- 1 If the Modbus master protocol is used, the *Maximal Number of Retries* parameter for a Modbus TCP slave can be set to a value greater than 0

Transmissions to the Modbus slave can thus be repeated at the Modbus protocol level after expiration of the receive timeout, even if the data are transferred via TCP.

Up to V5.10, such retries could only be set up for UDP and serial data transfer.

A current SILworX version is required to be able to perform the set-up. [HE22110]

- 2 If the Modbus master protocol is used, the online view of the Modbus gateway correctly displays the state of the connection to the gateway slave [HE20628]

- 3 The Modbus master protocol properly counts the number of non-connected slaves

The *Number of Faulty Slave Connections* system variable displays the correct value, even after the connection to the slave is lost and re-established multiple times. [HE22136]

- 4 The load on the X-COM 01 microprocessor caused by operation of the Modbus slave protocol has been reduced compared to V5.10

If the load resulting from master requests is zero or very low, the value of *Current μ P Budget* displayed in the online view goes down to 0. [HE22025]

5 Restrictions of V5.x

Some of these restrictions also apply to the previous versions.

5.1 Safety-Relevant Restrictions

- 1 SIL 3 applications of the X-CI 24 01 counter module

SIL 3 applications of X-CI 24 01 up to V5.x are only allowed if the counter module parameters are set as follows:

- Set the single edge counter mode
- Do not allow any deviation

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Set the system variables *Max. Dev. IO [UDINT]* → and *Max. Dev. CPU [UDINT]* → for each channel to 0.

- Ensure that no channel can automatically restart

Set the system variable *Restart [BOOL]* → for each channel to TRUE.

One pulse might not be counted if the frequency is below 500 Hz.

If the module is operating in double or quadruple edge counter mode, it does not record any deviation. For this reason, these modes of operation are not allowed for SIL 3 applications.

- 2 In the I/O modules X-DO 24 01, X-DO 24 02, X-DO 32 01, X-DO 12 02, the interval for short-circuit and open-circuit tests can only be set to a maximum of 32 seconds. If this point is not observed, a lower value is used.

5.2 General Restrictions

- 1 Autostart triggered by removing and reinserting two system bus modules or by switching the operating voltage off and on again

If both responsible system bus modules are removed and reinserted, an autostart previously set in the project is triggered even if the system was stopped beforehand using the PADT.

This behavior can also be triggered after switching the operating voltage off and on again. [HE20023]

- 2 Lost connections and timing inaccuracies within communication protocols

In communication protocols with time-critical, cyclic transmissions, e.g., PROFINET, the transmissions might reveal timing inaccuracies with very large process data volumes (e.g., 10,000 Modbus register variables). The cause is the load on the communication module. Depending on the setting of the send interval and connection monitoring watchdog, the connection of the subprotocol and thus of the protocol (e.g., PROFIsafe) could be aborted.

Workaround: HIMA recommends using multiple communication modules and separating time-critical protocols from protocols exchanging very large process data volumes.

- 3 Setting the system variable *Read-only in Run* has no effects

Setting the system variable *Read-only in Run* to TRUE has no effects if the user is logged in with "Read and Operate" rights. Operation, however, can still be stopped. [HE22271]

- 4 Module faults cannot be reset in X-CI 24 01

Module faults of the following type cannot be reset in X-CI 24 01.

- Reference voltage for open-circuits
- Reference voltage for short-circuits
- Module plugged in

Workaround: Restart the module using the PADT function **Restart Module**. [HE19836]

5.3 Restrictions with X-COM 01 V5.10

The restrictions described in this chapter are only related to X-COM 01 V5.10 (not to a previous version) and were eliminated in X-COM 01 V5.18!

- 1 SNTP client protocol

If the SNTP client protocol is active and the SNTP server is **available**, system bus communication between the HIMax system and the X-COM 01 module may be interrupted after 21 server requests from the SNTP client.

All external communication connections via the X-COM 01 module are interrupted and the ComUserTask is stopped.

With standard SNTP configuration (16 s request interval set on the SNTP client), communication is interrupted on the responding SNTP server after approx. 5-6 min.

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If an SNTP client protocol is configured, but no SNTP server is active, the described communication interruption does not occur. In this case, failure may occur if an SNTP server is activated at a later point in time. [HE22505]

6 Migrating from V2.x Through V4.x to V5.x

HIMA recommends upgrading the operating systems of X-CPU 01, X-SB 01, X-COM 01 and of the I/O modules when the system is stopped.

Particular care must be taken if the upgrade has to be performed while the system is operating. The OS loader upgrade can be skipped to avoid reducing redundancy for an unnecessarily long period. The OS loader should be upgraded when the system is stopped at the next earliest opportunity.

No further actions may be performed on the system during the upgrading process!

Prior to upgrading the operating systems, the HIMax system must be in a faultless state!

6.1 Procedure

One module in the RUN state may only be upgraded if the module that was lastly upgraded is once again completely operating!

The order described below must be absolutely observed!

The processor module is updated first such that the entire system update process proceeds faster.

1. Upgrade the first processor module. To this end:

- a Upgrade the operating system
- b Restart the module.

If a fault occurred while loading the operating system, the OS loader is started. If the OS loader was not upgraded at this point, it is only accessible via the standard IP address.

The normal operating system now uses the previously configured IP address.

- c Upgrade the OS loader, if not in V4.10 yet. The OS loader once again operates with the configured IP address.
- d Wait until the module is once again completely running in system operation. In particular, the process data communication for processor and communication modules should be completely re-established.

Notes:

- *The simultaneous use of processor modules with different operating system versions is only allowed for the duration of the upgrade!*
- *If safeethernet is used, the processor modules must be upgraded one after the other, without performing any actions in between!*

2. Upgrade the remaining processor modules. To do this, perform the steps a...d such as described for the previous modules.
3. Upgrade the system bus modules. To do this, perform the steps a...d such as described for the previous modules, if the OS version of X-SB 01 is not yet V4.18. First upgrade the modules on slots 1 in all racks, and then the modules on slots 2. The current OS loader version of X-SB 01 is V3.0.
4. Upgrade the communication modules. To do this, perform the steps a...d such as described for the previous modules. The current OS loader version of X-COM 01 is V4.10.
5. Upgrade the I/O modules. To do this, perform the steps a...d) such as described for the previous modules. The current OS loader version of the I/O modules with HIMaxIO_HA1_BS and _HA3_BS is V3.0. The current OS loader version of the I/O modules with HIMaxIO_HA2_BS is V4.10.

I/O modules, system bus modules and communication modules can be operated within a system using different operating system releases (V2.x, V3.x V4.x and V5.x).

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This does not apply for processor modules! Processor modules must be upgraded to the same version. Until this is done, a warning appears.

Observe the restrictions of the operating system versions currently in use!

7 Migrating from V1.x to V5.x

SILworX version must be changed when migrating from operating system V1.x to V5.x, since SILworX V1.x can only be used with HIMax V1.x and SILworX V2.x and higher can only be used with HIMax V4.x.

HIMax modules V1.x cannot be used together with HIMax modules V2.x and higher!

The migration procedure for SILworX projects corresponds to that described in the Release Notes for SILworX V2.36 and V2.46 and has to be adhered to.

The migration from V1.x to V5.x may only be performed if the system is stopped!

8 References

- HIMax System Manual, Document Number HI 801 001 E
- X-MIO 7/6 01 Manual, Document Number HI 801 305 E
- X-HART 32 01 Manual, Document Number HI 801 307 E