Content

1 New HIMax operating system release V4.x

1.1 Operating System Versions for the Various Modules

V4.x includes the following operating system versions:

- V 4.14 for processor modules
- V 4.8 for communication modules
- V 4.8 for system bus modules
- V 4.6 for I/O modules SIL 3
- V4.12 for I/O modules SIL 1 and standard

1.2 Overview

This document describes the improvements and new functions of version 4.x compared to the previous version:

- Chapter 2 describes the new functions of V4.x.
- Chapters 3 and 4 specify the improvements and provides information on the problems resolved in previous versions.
- Chapter 5 specifies the existing restrictions.
- Chapters 6 and 7 describe the procedures to migrate from the previous version.

1.3 Compatibility

V4.x supports all the functions of V3.x.

2 New Features of V4.x

V4.x contains the following new functions:

2.1 New I/O modules

X-AI 16 51	Analog input/temperature module (16 channels, 0/4...20 mA, ±280 mV, galvanically isolated, TC, Pt100, SIL 1)
X-AI 32 51	Analog input module (32 channels, 0/4...20 mA, line monitoring, standard)
X-AO 16 51	Analog output module (16 channels, 0/4...20 mA, standard)
X-CI 24 51	Counter module (24 channels, 0...20 kHz, standard)
X-DI 32 51	Digital input module (32 channels, 24 VDC, standard)
X-DI 32 52	Digital input module (32 channels, 8.2 VDC, proximity switch, line monitoring, standard)
X-DI 64 51	Digital input module (64 channels, 24 VDC, standard)
X-DO 12 51	Relay output module (12 channels 230 VAC/VDC, standard)
X-DO 32 51	Digital output module (32 channels, 24 VDC, 0.5 A, protected outputs, group shut-off; standard)

2.2 System Bus Supports Network Structure and Latencies

- In addition to the already supported line structure, the system bus can now be structured as a network. Each system bus module can establish up to three connections to other racks. If the CPU rack is extended by a suitable switch, the entire system bus can also be structured as a star, thus ensuring the maximum independence among the racks.
- For both the line structure and the network structure, the maximum latency on the system bus can be configured such that the system can be adjusted to potential delays caused by connections to remote racks. This results in the widest range of distribution options for the HIMax system racks, and therefore allows a system extension of many kilometers to be attained.

2.3 Communication Functions

- The processor module was extended by the PROFIsafe communication protocol, in accordance with the PROFIsafe specification for profile version 2.5c of PROFIBUS International. PROFIsafe can be used through the PROFINET protocol of the communication module.

2.4 New Mode for the Controller's Target Cycle Time

- Two new setting options for the Target Cycle Time Mode parameter
  - Fixed-tolerant
  - Dynamic-tolerant

  In situations requiring particularly time-intensive computing, such as during module synchronization or when activating the reload, these two tolerant modes allow one to use the cycle time beyond the configured target cycle time and almost up to the watchdog time.

3 Improvements of V4.x Compared to V3.x

3.1 Functions of the Processor Module

- Improved calculation and indication of the watchdog and cycle buffer times resultin even higher reliability during reload and when synchronizing the modules. The system can thus provide improved user protection against insufficient parameter setting and increase its availability.
- To improve the system start-up behavior, the processor module waits an extended period after powering up until all I/O modules have started.
- New parameter *Max. Duration of Configurations Connections [ms]* for the processor module, which allows one to set the time required for the configuration connections to the remote I/Os and for communicating with the PADT.
- If a user program in the processor module causes a fault, the state of the module's statistical values is recorded both before and immediately upon occurrence of the fault to simplify the fault cause analysis. [HE17527]
- It can now be set in the user program if the user program should start simultaneously with the processor module or it should remain in the STOP state. [HE17700]

3.2 Functions of the I/O Modules

- If background tests cannot be successfully completed within the scheduled time period, the I/O module enters the STOP state (previously: Restart). This facilitates the fault diagnosis. The other system modules remain in operation.
- Reducing the safety time during operation using a PADT command or by performing a reload safely affects the I/O modules at the latest upon expiration of the safety time that was effective when the change was performed.

3.3 Reload Extension

Additionally, reload allows one to change the following configuration data:

- Firmware user accounts
- Firmware licenses
- Time slices for process data communication
- Configuration and module names for processor and I/O modules

3.4 LED Indicators

- The LED diagnostic concept was standardized such that the ERROR LED for a module:
  - is continuously lit to indicate warnings
  - blinks to indicate errors.

- The deviation between the firmware licenses loaded with the configuration and the demo licenses used in excess thereof is now treated as a warning and therefore signaled with a continuously lit ERROR LED.
  This is a clear signal for users that the system is not operating in a regular mode and must be adjusted for continuous operation.

3.5 ComUserTask

- More communication module resources can be used for the ComUserTask (CUT):
  - 24 kByte non-volatile memory
  - 512 kByte main memory for program and data
  - Larger UDP data frames with up to 1472 bytes user data
  - The SSI submodule can be used with the ComUserTask
- The ComUserTask (CUT) development environment was extended. The following Microsoft operating systems are now supported:
  - Windows XP (32-bit)
  - Windows Vista (32-bit)
  - Windows 7 (32-bit and 64-bit)

3.6 Miscellaneous

- Starting with V4.x, the system bus module also reports overvoltage through a system fault counter for the Warning category.

4 Problems Resolved

4.1 Processor Module Problems Resolved

Compared to V3.x of the processor module, the following problems were removed:

- *Restart in connection with reload and sequence of events recording*
  In the previous version of the processor module, a restart could be triggered in seldom, time-critical cases when a project configuration with sequence of events recording (SOE) was reloaded. [HE17808]
- *Reload deactivation*
  The system variable Reload Deactivation was not taken into account in V3.x of the processor module. This problem was removed in V4.x. [HE17238]
- *Warm start command from the test mode*
  In V4.x, a warm start is still not possible from TEST_MODE if the user programs do not include retain variables. The PES rejects now the corresponding PADT command and signals it to the users in a clearly visible manner, instead of simply creating a diagnostic entry. [HE18544]

4.2 I/O Functions Problems Resolved

Compared to V3.x of the I/O modules, the following I/O problems were removed in V4.x:

- *Error when calculating the frequency of X-CI 24 01*
  In V3.x, the frequency calculated for the X-CI 24 01 was excessively high if the counter pulses were absent for an extended period after which new pulses reached the X-CI 24 01 once again. This problem was removed in V4.x of the I/O module. [HE17840]

- *Invalid configuration when starting with an error*
  In V3.x, I/O modules behaved in a faulty manner if the following steps were performed in the following sequence:
  - I/O module restarted after an unsuccessful self-test, e.g., due to variations in the supply voltage)
  - Loading of the I/O module configuration
  - Subsequent self-test completed successfully

  In such a case, the I/O module ignored the loaded configuration and started operation with default settings , without taking the configuration into account. This problem was removed in V4.x of the I/O modules. [HE17628]
- *Restart of all the I/O modules during online change of watchdog time and safety time*
  Up to V3.x, if the watchdog time and safety time were in certain seldom constellations and were changed during operation using a PADT command or by performing a reload, all I/O modules were restarted. This problem was removed in V4.x of the I/O modules. [HE17497]
- *Acknowledgment after removing an I/O module*
  In V3.x, if an I/O module was removed from the configuration by performing a reload, it had to be acknowledged, to re-add it to the configuration by performing a successive reload. The acknowledgment is no longer required in V4.x of the I/O modules. [HE16876]
- *Current process values for the I/O modules added during the reload*
  In V3.x of the I/O modules, if new I/O modules were added to the configuration by performing a reload, they first provided safe data to the processor module. In V4.x of the I/O modules, they provide immediately current process values to the processor module. [HE18852]

4.3 Communication Functions Problems Resolved

- *Availability restrictions with redundant safe**ethernet** via X-COM 01*
  Up to V3.x, a redundant safe**ethernet** connection could bring the process data communication to a standstill and extend the CPU cycle up to the configured communication processing time. The pre-requisites were:
  - The transmission paths ran through two different communication modules of type X-COM 01.
  - One of these communication modules was faulty, not inserted or in the STOP state.
  - No other, non-redundant communication protocol was configured for the faulty/not inserted/stopped communication module.

  [HE18779], [HE19535]
  This problem was removed in V4.x of X-CPU 01.
- *Redundant safe**ethernet** sporadically disturbed*
  In V3.x, a redundant safe**ethernet** connection with transmission paths running through a single communication module could fail very sporadically. This problem was removed in V4.x of X-CPU 01. [HE19069]
- *Starting up larger configurations of remote I/Os*
  It is now possible to load and start up configurations with a large number of HIMatrix remote I/Os (e.g., more than 120 devices) and/or slower communication connections. To this end, the resource's parameter Max. Duration of Configuration Connections [ms] must be set to a suitable value. [HE17358]
- *Processor module restart if the connection on the system bus is disturbed*
  Up to V3.x of the X-CPU 01 operating system and in very rare cases, it could happen that all redundant X-CPU 01 within a HIMax system would restart due to disturbances in the internal communcation connection of X-CPU 01 to X-SB 01 or X-COM 01. This fault occurred if the connection state (frequently) switched between Not Disturbed and Disturbed.
  Up to now, this fault was only observed in a system, in which the state of the connection to a X-SB 01 changed multiple times per second. This fault was removed in V4.x of the X-CPU 01. [HE21430]

- *Slots for redundant Modbus Slave*
  In V3.x, if the X-COM 01 was used with a redundant Modbus function, it was possible that an X-COM 01 would no longer be operational. This could happen if:
  a) the X-COM 01 was inserted in rack.slot=0.5 and a X-CPU in rack.slot =1.3, or vice versa
  b) the X-COM 01 was inserted in rack.slot=0.6 and a X-CPU in rack.slot =1.4, or vice versa
  With V4.x, the redundant Modbus slave slots described above can be used without restrictions. [HE20945]
- *Default switch settings*
  Starting with V4.x, if a processor module with switch set to INIT is started, the default parameters are also used for the integrated switch.
- *Initial HH connection status set to invalid*
  Starting with V4.x of the communication and processor modules, if the *HH Connection Status* was not determined using the ping function, the status is set to invalid.
  Note: The parameter *HH Connection Status* was renamed to *Ping Status* in SILworX V4.64 and beyond. [HE17695]
- *Communication error counter for SNTP server*
  Starting with V4.x, the communication and processor modules properly control the communication error counter, the next time the external SNTP server can be reached. [HE16746]
- *Initial data of standard communication protocols*
  Starting with V4.x of the processor module, if explicitly set, the initial data are used if a communication module is removed or stopped. [HE12061]
- *Processor load monitoring for Modbus slaves*
  In V4.x of the communication module, processor load monitoring for Modbus slaves has been improved to such a degree that blockades no longer occur, even in rare circumstances. [HE17003]

5 Restrictions of V4.x

5.1 Safety-Relevant Restrictions

- *SIL 3 applications of the X-CI 24 01 counter module*
  All SIL 3 applications of X-CI 24 01 up to V4.x are only allowed with the following parameter setting:
  - Set the single edge counter mode
  - Do not allow any deviation
    Set the system variable *Max. Dev. IO [UDINT]* → and *Max. Dev. CPU [UDINT]* → for each channel to 0
  - Prevent all channels from restarting automatically
    Set the system variable *Restart [BOOL]* → to TRUE for each channel

  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.

5.2 General Restrictions

- *Autostart triggered by removing and reinserting two system bus modules or by switching the supply voltage off and on*
  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 supply voltage off and on again.
  This applies to processor modules up to V4.x. [HE20023]
- *No firmware upgrade of I/O modules with OSL V2.6*
  I/O modules with active OSL V2.6 cannot be upgraded to firmware V4.x and beyond.

Workaround: Prior to upgrading the firmware, upgrade the OSL to the corresponding current version.

- *Module faults cannot be reset in X-CI 24 01*
  If a module fault occurs in an X-CI 24 01, it cannot be reset, even if the hardware is restored to a fault-free state.
  Workaround: Stop the module's system operation via PADT command and restart the module. [HE19836]

- *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.

- *Firmware licenses for communication protocols, which have been loaded by performing a reload, become active after loading the communication module once again.*
  A firmware license for a communication module or ComUserTask, which was loaded into the system by performing a reload, is only effectively used by a communication module after loading it once again. For this reason, a license possibly missing before, is signaled with a warning.
  Note: A new loading process is started if the communication module enters system operation once again.

6 Migrating from V2.x and V3.x to V4.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. 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.

   Note: The simultaneous use of processor modules with different operating system versions is only allowed for the duration of the upgrade!
   *Note: If safe**ethernet** 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) through d) such as described for the previous modules.

3. Upgrade the system bus modules. To do this, perform the steps a) through d) such as described for the previous modules. First upgrade the modules on slots 1 in all racks, and then the modules on slots 2.
4. Upgrade the communication modules. To do this, perform the steps a) through d) such as described for the previous modules.
5. Upgrade the I/O modules. To do this, perform the steps a) through d) such as described for the previous modules

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

SILworX version must be changed when migrating from operating system V1.x to V4.x, since SILworX V1.x can only co-operate with HIMax V1.x and only SILworX V2.x and beyond, can co-operate with HIMax V4.x.
HIMax modules V1.x cannot be used together with HIMax modules V2.x and beyond!
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 V4.x may only be performed if the system is stopped!

8 References

- HIMax System Manual, Document Number HI 801 001 E