3.4.11 Indicators

The following figure shows the LED indicators for the processor module. These LEDs are located on the front plate, on the upper part of the module. The mode switch described in Chapter 3.4.18 is also located on the front plate of the module.

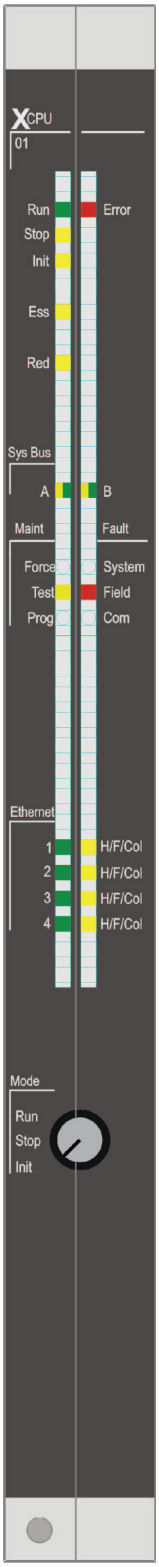

Figure 4: Front View with LEDs and Mode Switch

The LEDs indicate the operating state of the processor module. All LEDs should be considered together. The LEDs on the module are divided into six groups:

- Module status indicators (Run, Error, Stop, Init)
- Redundancy indicators (Ess, Red)
- System bus indicators (A, B)
- Maintenance indicators (Force, Test, Prog)
- Fault indicators (System, Field, Com)
- Ethernet indicators (Eth1...4, H/F/Col1...4)

When the supply voltage is switched on, a LED test is performed and all LEDs briefly flash simultaneously.

Definition of Blinking Frequencies

The following table defines the blinking frequencies of the LEDs:

Name	Blinking Frequencies
Blinking1	Long (approx. 600 ms) on, long (approx. 600 ms) off
Blinking2	Short (approx. 200 ms) on, short (approx. 200 ms) off, short (approx. 200 ms) on, long (approx. 600 ms) off
Blinking-x	Ethernet communication: Flashing in sync with data transfer

Table 5: Blinking Frequencies of LEDs

3.4.12 Module Status Indicators

These LEDs are located on the front plate, on the upper part of the module.

LED	Color	Status	Description
Run	Green	On	Module in RUN, normal operation
		Blinking1	Module state: STOP/OS_DOWNLOAD or OPERATE (only with processor modules)
		Off	Module not in RUN, observe the other status LEDs
Error	Red	On/Blinking1	Internal module faults detected by self-tests, e.g., hardware, software or voltage supply. Fault while loading the operating system
		Off	Normal operation
Stop	Yellow	On	Module state: STOP / VALID CONFIGURATION
		Blinking1	Module state: STOP / INVALID CONFIGURATION or STOP / OS_DOWNLOAD
		Off	Module not in STOP, observe the other status LEDs
Init	Yellow	On	Module state: INIT, observe the other status LEDs
		Blinking1	Module state: LOCKED, observe to the other status LEDs
		Off	Module state: neither INIT nor LOCKED, observe the other status LEDs

Table 6: Module Status Indicators

3.4.13 Redundancy Indicators

LED	Color	Status	Description
Ess	Yellow	On	**Do not remove the module!** The module is absolutely required for operating the HIMax system. Only one module is configured.
		Blinking1	**Do not remove the module!** The module is absolutely required for operating the HIMax system. Multiple redundant modules are configured.
		Off	The module is not absolutely required for operation. It may be removed, if required.
Red	Yellow	On	The module is operating redundantly with at least one additional module.
		Blinking1	At least one processor module starts system operation or less modules than planned are operating redundantly.
		Off	The module is not operating redundantly.

Table 7: Redundancy Indicators

3.4.14 System Bus Indicators

The system bus LEDs are labeled *Sys Bus.*

LED	Color	Status	Description
A	Green	On	Physical and logical connection to the system bus module in slot 1.
		Blinking1	No physical connection to the system bus module in slot 1.
	Yellow	Blinking1	The physical connection to the system bus module in slot 1 has been established. No connection to a (redundant) processor module running in system operation.
B	Green	On	Physical and logical connection to the system bus module in slot 2.
		Blinking1	No physical connection to the system bus module in slot 2.
	Yellow	Blinking1	The physical connection to the system bus module in slot 2 has been established. No connection to a (redundant) processor module running in system operation.
A+B	Off	Off	Neither physical nor logical connection to the system bus modules in slot 1 and slot 2.

Table 8: System Bus Indicators

3.4.15 Maintenance Indicators

The maintenance LEDs are labeled *Maint*.

LED	Color	Status	Description
Force	Yellow	On	Forcing prepared, processor module in STOP, RUN or RUN / UP STOP
		Blinking1	Forcing active, processor module in RUN or OPERATE
		Off	Forcing inactive
Test	Yellow	On	Connection to the PADT with write permission
		Blinking1	At least one user program is in the RUN_FREEZE state (single step operation)
		Off	No connection to the PADT with write access and no user program in the RUN_FREEZE state
Prog	Yellow	On	Download (processor module in STOP), the configuration is being loaded, A PADT write command is being processed
		Blinking1	Reload procedure active or exchange of configuration data between processor modules
		Off	No loading procedure active and no configuration data exchange between processor modules

Table 9: Maintenance Indicators

3.4.16 Fault Indicators

The fault LEDs are labeled *Fault*.

LED	Color	Status	Description
System	Red	On	System warning, only if no module fault occurred in a HIMax system module.
		Blinking1	Faults detected in a HIMax system module, e.g., hardware, software, over temperature or power supply. The module or base plate is missing or does not match the configuration or cannot be operated as intended.
		Off	No module fault displayed for a HIMax system module
Field	Red	On	Field warning, only if no field fault occurred in a HIMax system I/O module
		Blinking1	Field faults in an I/O module of the HIMax system
		Off	No field faults displayed for an I/O module in the HIMax system
Com	Red	On	COM warning, only if no faults occurred in the external process data communication
		Blinking1	Fault in the external process data communication
		Off	No faults displayed for the external process data communication

Table 10: Fault Indicators

3.4.17 Ethernet Indicators

The Ethernet LEDs are labeled *Ethernet*.

LED	Color	Status	Description
Eth 1…4	Green	On	Communication partner connected No communication detected on interface
		Blinking-x	Communication detected on interface.
		Blinking1	IP address conflict detected All Ethernet LEDs are blinking
		Off	No communication partner connected
H/F/Col 1…4	Yellow	On	Full duplex operation on Ethernet line *F*
		Blinking-x	Collisions detected on Ethernet line *Col*
		Blinking1	IP address conflict detected All Ethernet LEDs are blinking
		Off	Half duplex operation on Ethernet line *H*

Table 11: Ethernet Indicators

3.4.18 Mode Switch

The mode switch defines how the processor module behave when restarted.

The processor module is restarted in the following cases:

- Automatically:
  - When connecting the operating voltage
  - After a severe failure
  - After loading the operating system
- During operation, using the corresponding command on the PADT.

The mode switch has three different switch positions:

- Init
- Stop
- Run

The switch position during normal operation is Run.

Switch Position: Init

The Init switch position is used to set the processor module to the LOCKED states. In this state, the settings previously configured for the module can no longer be accessed. This can be required if, for instance, the administrator password is unknown.

In the LOCKED state, the module is reset to the factory settings:

- Default SRS, the slot number depends on the slot used
- Default IP address and IP settings
- Only accessible for *Administrator* user account with empty password
- Enabling switches set to default values

Setting values that are are modified in this state overwrite the factory settings and all the settings previously used!

If the settings remain unchanged, the previously saved settings are used when the module is restarted (the switch is not set to Init).

Transition from LOCKED State to Exclusive System Operation

Prerequisite:

- Processor module state: LOCKED

The system operation is started if one of the following events occur:

- The position of the mode switch changes from Init to Run or Stop
- The user sends a command from within the PADT.

The controller might not restart automatically after interrupting the operating voltage

If the mode switch of one processor module is in the Init position and this processor module is accidentally the first to be started when the operating voltage is reconnected, it remains in the LOCKED state and does not adopt system operation.

If an Autostart is required after interrupting the operating voltage, the mode switches on all the processor modules must be set to Run!

Turn the mode switch quickly from Init to Run to prevent the processor module from entering the STOP state.

Switch Position: Stop

Only operative if the processor module is not operating redundantly.

Effect:

- Non-redundant operation:
  The processor module disables any pre-configured Autostart and remains in STOP.
- Redundant operation:
  The processor module adopts the same operating state as the other processor modules.

The controller might not restart automatically after interrupting the operating voltage

If the mode switch of one processor module is in the Stop position and this processor module is accidentally the first to be started when the operating voltage is reconnected, it remains in the STOP state. Consequentially, also the remaining processor modules cannot start.

If an Autostart is required after interrupting the operating voltage, the mode switches on all the processor modules must be set to Run!

Switch Position: Run

To set for safety-related operation!

Effect:

- Non-redundant operation:
  The processor module starts the user programs if Autostart is activated.
- Redundant operation:
  The processor module adopts the same operating state as the other processor modules.

Overview of Switch Positions

Module behavior if the module starts after switching on the operating voltage or after a fault:

Switch Position	Only individual processor module	Additional processor module (redundant operation)
Init	Enters the LOCKED state with the factory settings	
Switch from Init to Stop	Enters the STOP state	Starts redundant operation
Switch from Init to Run	Starts operation, if the *Autostart* system parameter is set to TRUE	
Init: Command from PADT ▪ System operation ▪ Cold Start	Enters RUN state (mono operation)	
Stop	Enters the STOP state	
Run	Executes the user programs.	

Table 12: Overview of the Mode Switch Positions

3.4.19 Monitoring the Operating Voltage

The HIMax processor module monitors its supply voltages L1+/L1-, L2+/L2-. The following applies for each supply voltage:

Voltage level	Voltage status
< approx. 18 V	supply voltage faulty
otherwise	Supply voltage OK

Table 13: Supply Voltage Status

NOTE

Controller damage due to excessively high operating voltage!

Do not connect supply voltage exceeding 30 volts

3.4.20 Monitoring the Temperature

Sensors continuously monitor the operating temperature of the modules.

The temperature status of a processor module indicates wether the temperature thresholds have been exceeded with respect to the following environment temperature ranges:

Temperature range (approx.)	Temperature status
< 40 °C	Temperature OK
40...60 °C	Temperature threshold 1 exceeded
> 60 °C	Temperature threshold 2 exceeded

Table 14: Temperature Status

If the temperature exceeds a specific threshold or falls below it, the temperature status changes.

Table 14 applies to normal operation with operating fans. In case of abnormal operation, e.g., without fans, the temperature status can indicate that the temperature thresholds have been exceeded even at a lower environment temperature.

The temperature status is a status of the processor module. After logging in to the processor module, the module status is displayed in the SILworX Control Panel.

NOTE

Module damage due to overtemperature!

The HIMax modules may only be operated in conjunction with a X-FAN 01 Fan Rack or a replacement type.

3.4.21 Operating System

The operating system loaded into the CPU contains all basic functions of the HIMax programmable electronic system (PES), for example:

- Processing the user programs,
- Performing all test routines for hardware and software
- Cycle time monitoring (watchdog)
- Safe communication with the I/O modules
- Safe communication with other systems, such as:
  - HIMax
  - HIMatrix
- Creating and storing events.

For a description of the operating system functions, see the System Manual (HI 801 001 E).

Cycle Processing

A CPU cycle runs through the following phases:

- Reading the input data
- Processing the user programs
- Writing the output data
- Other activities, e.g., reload processing.

3.5 Product Data

Parameter	Value
Supply voltage	24 VDC, -15 %...+20 %, $r_P \leq 5$ %, SELV, PELV
Current input	1.4 A
Fuse (internal)	7.5 A
Microprocessor	PowerPC
Flash EPROM	128 MB
DDRAM, NVRAM	256 MB
Program memory for each user program	1023 kB
Data memory for variables per user program	1023 kB
Total program and data memory for all user programs	10 MB less 4 kBytes for CRCs
Data memory for retain variables	
per user program	2 kB
A total for all user programs	32 kB
Number of variables being able to trigger events	20 000
Number of events that can be stored	5000
Safety time	≥ 20 ms, depending on the application
Buffer for date/time	Gold capacitor
Operating temperature	0 °C...+60 °C
Storage temperature	-40 °C...+85 °C
Humidity	max. 95 % relative humidity, non-condensing
Type of protection	IP20
Dimensions (H x W x D) in mm	approx. 310 x 29.2 x 236
Weight	approx. 1.3 kg

Table 15: Product Data