Sx-IP

IP67 versatile

Xenon Flash

SERVICE SOFTWARE

MANUAL

2.x software revisions

1 TABLE OF CONTENTS

2   SX-IP FUNCTIONNAL OVERVIEW

2.1.1   OPERATING MODES

Sx-IP operating mode is configurable. Two modes are available:

- Energy regulation: The Sx-IP adjust the flash time to the expected flash energy according to the last flash energy. This mode is intended to be used when the flashes are requested at constant frequency.
- Burst mode: The Sx-IP use reference tables to adapt the flash time to the capacitors' voltage. It allows to chain flashes of constant energy in high frequency bursts without recharging.

Design notes:

Operating mode is a Factory setting.

2.1.1   SX-IP FLASH SEQUENCE OVERVIEW

Sx-IP flash sequence is initiated with an unactive to active edge on one of the trigger's inputs.

Sequence starts with a deglitch time that can be configured from 10µs to 255µs. Refer to §5.5.

The end of the deglitch time is referenced as T0.

The light emission does not start at T0 but after a minimum 10µs delay. This delay is referenced as "flash delay" and can be configured from 10µs to 60ms. Refer to §5.5.

The flash duration is referenced as "ftime". The ftime parameter is computed accordingly to the requested flash energy and the operating mode.

Flash status (energy, errors…) is available after a 2ms resume delay.

The Sx-IP is ready for the next flash after observing a recovery time that is a factory setting (usually 30ms).
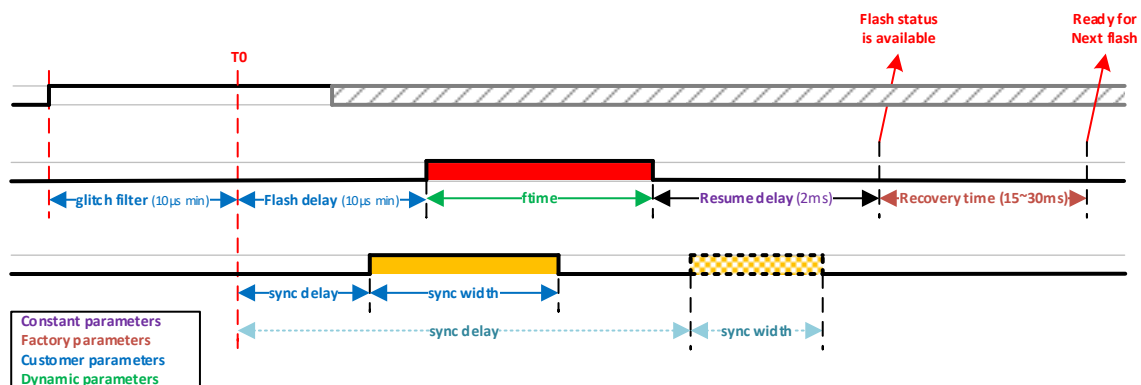
Sx-IP is also able to generate a synchronization signal with configurable delay and pulse with. Refer to §5.5.

2.1.2   SX-IP TRIGGER MANAGEMENT OVERVIEW

Sx-IP include **four logical triggers**. Each of this logical trigger is associated with:

- **A primary and alternate energy level** that is selected from the corresponding *ENERGY_LEVEL_PRESET* register
- **A physical trigger source** (input) that is selected from the *TRIGGER_INPUT_SEL* register

Each logical trigger is armed with energy (*ENERGY[1:4]*) and flash time (*FTIME[1:4]*) values that are read from tables according to:
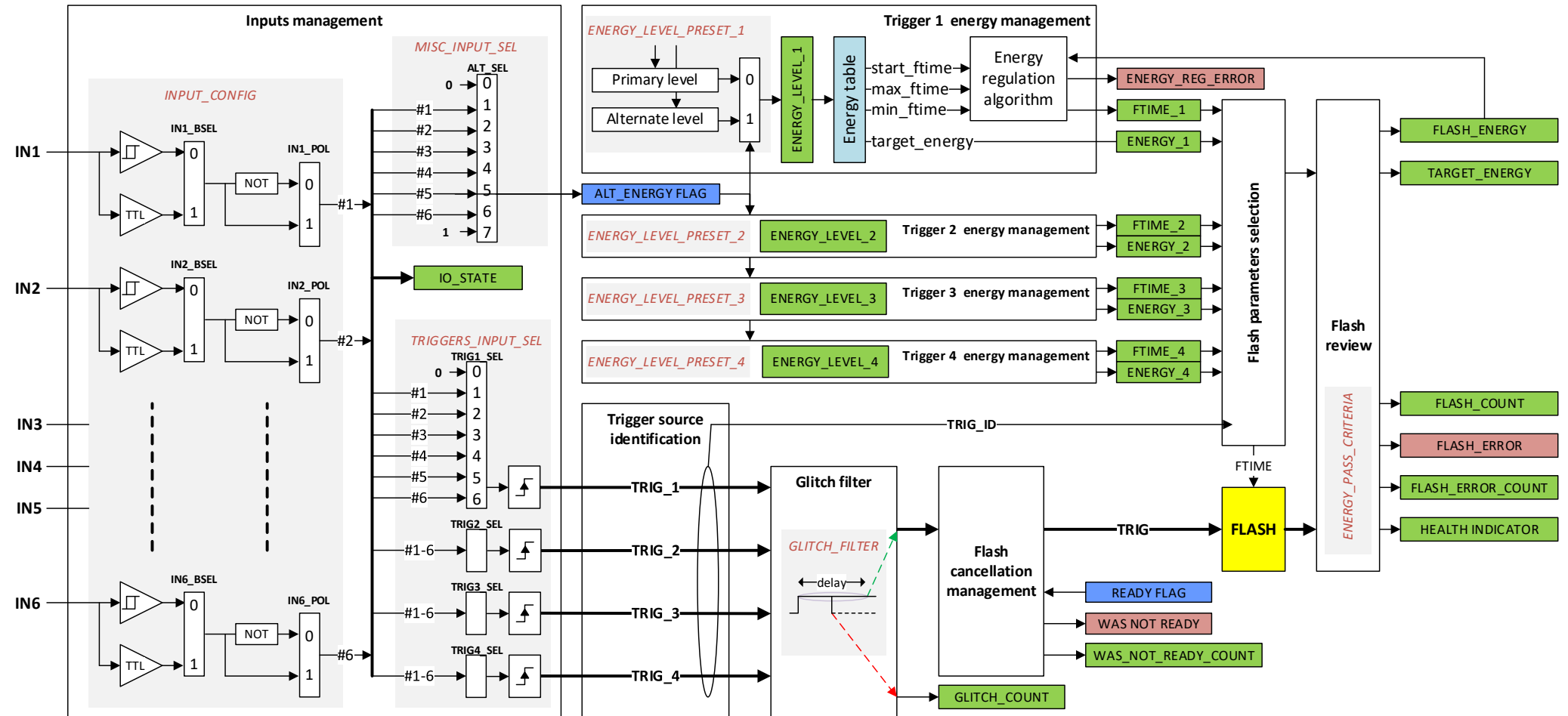
- The operating mode
- The alternate energy flag that can be associated to an input state using the *MISC_INPUT_SEL* register
- The energy storage voltage

When one of the inputs configured as trigger source is activated:

- The input is identified to select the flash parameters (energy and flash time) armed in the logical trigger associated with the input
- During the glitch filter time, the triggered source input is supervised to detect state changes. If the active state is not hold for the glitch filter time, the flash request is aborded and *GLTICH_COUNT* is incremented.
- The system check that the device is ready to flash. If not, the flash is aborded, the *WAS_NOT_READY* flag is set and *WAS_NOT_READY_COUNT* is incremented
- The flash is triggered

After the flash:

- *FLASH_ENERGY* is computed and compared to the *TARGET_ENERGY* energy using *ENERGY_PASS_CRITERIAS*.
- If the *FLASH_ENERGY* is correct, *FLASH_COUNT* is incremented
- If the *FLASH_ENERGY* is not correct, *FLASH_ERROR* flag is set, *FLASH_ERROR_COUNT* and *HEALTH_INDICATOR* registers are incremented
- In energy regulation mode, the flash time associated with the triggered logical trigger is adjusted according to the *FLASH_ENERGY*. If regulation limits are reached *ENERGY_REG_ERROR* flag is set.

Inputs management

INPUT_CONFIG

MISC_INPUT_SEL

ALT_SEL

IN1 — IN1_BSEL [0/1] — NOT — IN1_POL [0/1] — #1

IN2 — IN2_BSEL [0/1] — NOT — IN2_POL [0/1] — #2

IN3

IN4

IN5

IN6 — IN6_BSEL [0/1] — NOT — IN6_POL [0/1] — #6

0, #1, #2, #3, #4, #5, #6, 1 → 0,1,2,3,4,5,6,7

IO_STATE

TRIGGERS_INPUT_SEL

TRIG1_SEL: 0, #1, #2, #3, #4, #5, #6 → 0,1,2,3,4,5,6 → TRIG_1

TRIG2_SEL: #1-6 → TRIG_2

TRIG3_SEL: #1-6 → TRIG_3

TRIG4_SEL: #1-6 → TRIG_4

Trigger source identification

TRIG_ID

Trigger 1 energy management

ENERGY_LEVEL_PRESET_1

Primary level / Alternate level → [0/1] → ENERGY_LEVEL_1 → Energy table

start_ftime, max_ftime, min_ftime → Energy regulation algorithm

target_energy

ENERGY_REG_ERROR

FTIME_1

ENERGY_1

ALT_ENERGY FLAG

ENERGY_LEVEL_PRESET_2 — ENERGY_LEVEL_2 — **Trigger 2 energy management** — FTIME_2, ENERGY_2

ENERGY_LEVEL_PRESET_3 — ENERGY_LEVEL_3 — **Trigger 3 energy management** — FTIME_3, ENERGY_3

ENERGY_LEVEL_PRESET_4 — ENERGY_LEVEL_4 — **Trigger 4 energy management** — FTIME_4, ENERGY_4

Flash parameters selection

FTIME

Glitch filter

GLITCH_FILTER — delay

Flash cancellation management

TRIG

READY FLAG

WAS NOT READY

WAS_NOT_READY_COUNT

GLITCH_COUNT

FLASH

Flash review

ENERGY_PASS_CRITERIA

FLASH_ENERGY

TARGET_ENERGY

FLASH_COUNT

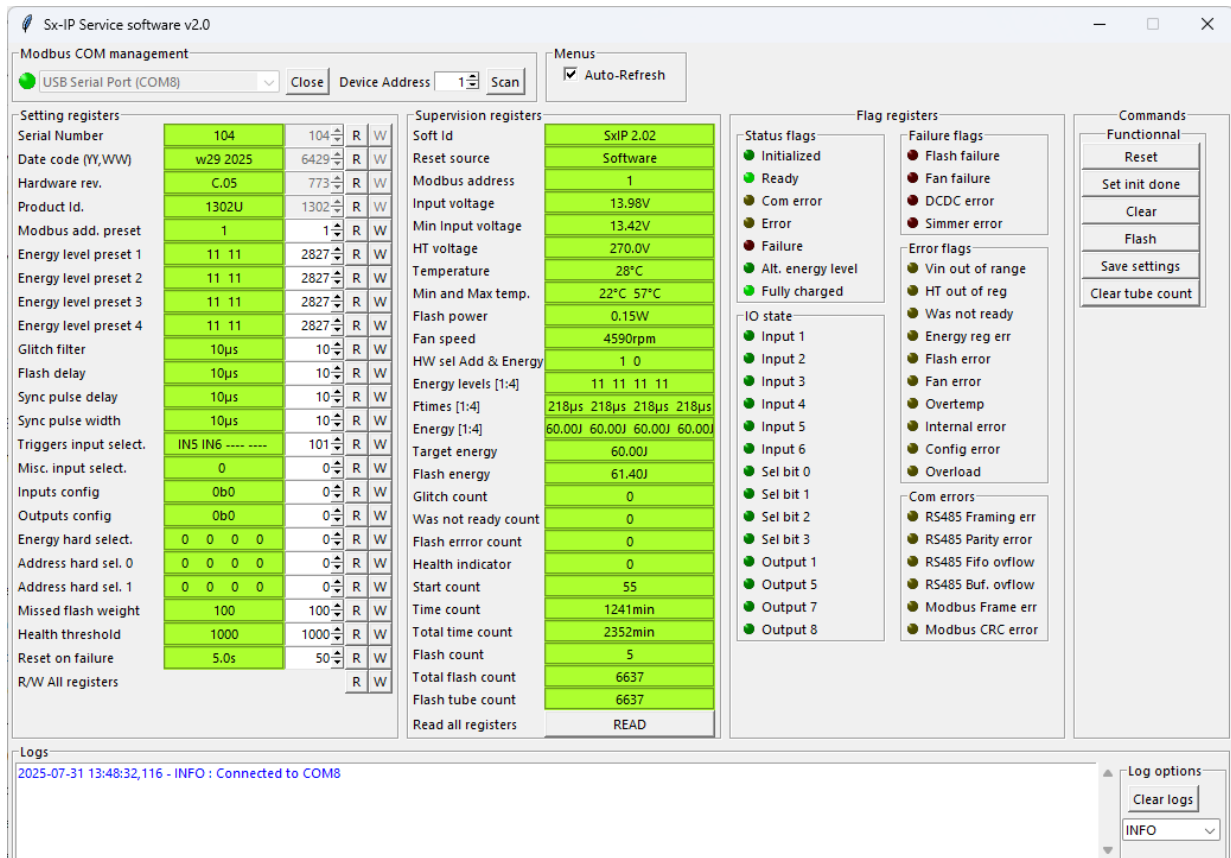FLASH_ERROR

FLASH_ERROR_COUNT

HEALTH INDICATOR

3　SERVICE SOFTWARE OVERVIEW:

The service software is available for window platforms and Linux platforms on request.

It allows configuration, monitoring, test and firmware update of Sx-IP devices.

The main window is divided is several sections:

- Modbus COM management section is for COM port and Modbus address selection
- Setting registers section is for configuring the device
- Supervision registers section is to access internal data
- Flag registers section is for supervision of the device's state and errors
- Commands sections allow to send commands to the device

4   CONNECT TO THE DEVICE

The flash device shall be properly powered and connected to the computer using a RS485 adapter.

We recommend to use service cable and power supply from Phoxene.

4.1   COM PORT SELECTION
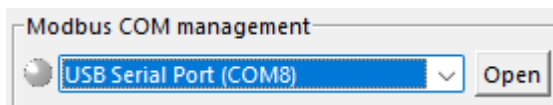
Select the COM port corresponding to the RS-485 interface on click on Open

4.2   MODBUS DEVICE ADDRESS SELECTION

Default Modbus address is 1.

If the flash device's Modbus address has been modified, you can use the Device Address spin box to change it.

In the eventuality that the device's address is unknow, you can use the Scan button to find it.

5   SETTING REGISTERS

Setting registers are in read and write access. Write access is according to privileges. Some registers' write access is reserved for factory.

5.1   SETTINGS REGISTERS OVERVIEW

First column is the register's name

Colored column is the explain registers' content

The third column allows to select a new value.

R button is for individual read of the register

W button is for individual write of the register

On the last row, **R** and **W** buttons allow to read or write all setting registers in a single operation

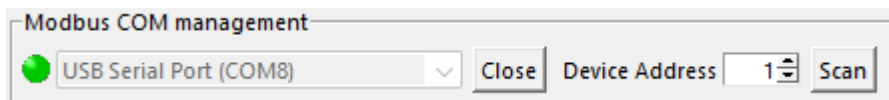| Setting registers				
Serial Number	104	104	R	W
Date code (YY,WW)	w29 2025	6429	R	W
Hardware rev.	C.05	773	R	W
Product Id.	1302U	1302	R	W
Missed flash weight	100	100	R	W
Health threshold	1000	1000	R	W
Reset on failure	5.0s	50	R	W
Modbus add. preset	1	1	R	W
Energy level preset 1	4 2	1026	R	W
Energy level preset 2	6 3	1539	R	W
Energy level preset 3	7 4	1796	R	W
Energy level preset 4	8 5	2053	R	W
Glitch filter	10µs	10	R	W
Flash delay	10µs	10	R	W
Sync pulse delay	10µs	10	R	W
Sync pulse width	10µs	10	R	W
Flash period	1000ms	1000	R	W
Inputs config	0b0	0	R	W
outputs config	0b0	0	R	W
Energy hard select.	0 0 0 0	0	R	W
Address hard sel. 0	SL3 SL2 SL1 SL0	47768	R	W
Address hard sel. 1	0 0 0 0	0	R	W
Triggers input select.	IN5 IN6 ---- ----	101	R	W
Misc. input select.	IN1	1	R	W
R/W All registers			R	W

Design notes:

When writing a register, new settings are accounted but are not retained after a device reset.

In order to save current settings, a SAVE_SETTINGS command is requested. Refer to §8.

5.2   FACTORY SETTINGS (READ ONLY)

Serial number: Device serial number

Date code: Manufacturing Week and Year

Hardware rev.: Hardware revision code with a letter as major key and two digits as minor key

Product id.: Product identification number

5.3   MODBUS ADDRESS SELECTION

Modbus add. preset register allow to assign a Modbus address to the device.

Allowed Modbus addresses are from 1 to 247.

Writing 0 make the Modbus address to be read from hardware selection (**Hw sel addr**). Refer to §5.11.
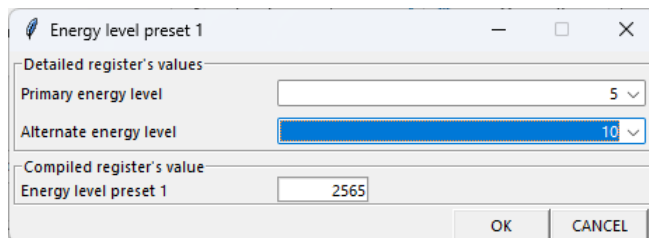
5.4   ENERGY LEVELS SELECTION

Energy level preset [1:4]:

A detailed configuration windows is accessible by clicking on the register's value (colored area).

For each of the four logical triggers, it allows to set the two energy levels from 0 to 15 or from hardware selection (**Hw sel energy**). Refer to §5.10.

Primary energy level is the default energy level preset assigned to the logic trigger.

Alternate energy level is the alternate energy level preset assigned to the logic trigger.

For more information concerning alternate levels, refer to §2.1.2.

5.5   TIMING SETTINGS

In order to understand timing parameters functional impact, please refer to §2.1.1

Glitch filter: Deglitch time before hardware trigger is accounted. From 10µs to 255µs.

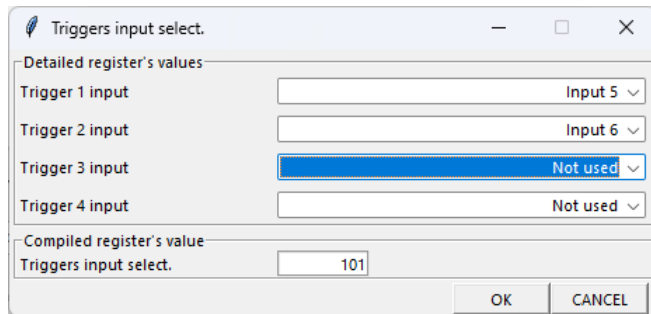**Flash delay**: Delay from the flash request to the occurrence of the flash. From 10µs to 60ms.

Sync delay: Delay from the flash request to sync signal activation. From 0µs to 60ms.

Sync pulse width.: Synchronization signal pulse width. From 0µs to 5ms.

5.6   TRIGGERS INPUT SELECTION

Triggers input select register allows to associate a physical input to each of the four logical triggers.

A detailed configuration windows is accessible by clicking on the register's value (colored area).

For more information concerning triggers management, refer to §0

5.7   ALTERNATE INPUT SELECTION

Misc. Input select Register allows to associate a physical input to the alternate level function.

A detailed configuration windows is accessible by clicking on the register's value (colored area).

The alternate input allows to switch between primary and alternate energy levels. Its may be useful for example day / night management.

For more information concerning triggers management, refer to §0

5.8   INPUTS POLARITIES AND BUFFERS

Input config register set inputs' polarity and buffer type.

A detailed configuration windows is accessible by clicking on the register's value (colored area).

For details concerning input buffers refer to the Sx-IP user guide.

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5.9   OUTPUTS CONFIGURATION

Output config register set outputs' polarities and functions

A detailed configuration windows is accessible by clicking on the register's value (colored area).

It allows for each output to select a polarity and a function.

Mode values:

Released: The output is released (pulled high) whatever the polarity.

Forced low: The output is low whatever the polarity.

Synchronization output: The output is configured to output the synchronization signal.

5.10 ENERGY LEVEL HARDWARE SELECTION

Energy hard select registers set the combination of inputs that will generate the hardware selected energy level (**HW sel energy**).

5.10.1 SELECTION EXEMPLES

Energy level hardware selection is from the optional selector:

Parameter	ENERGY_HSEL_3	ENERGY_HSEL_2	ENERGY_HSEL_1	ENERGY_HSEL_0
Selection	Selector bit 3	Selector bit 2	Selector bit 1	Selector bit 0

Energy level hardware selection is from inputs 1 to 4 state:

Parameter	ENERGY_HSEL_3	ENERGY_HSEL_2	ENERGY_HSEL_1	ENERGY_HSEL_0
Selection	Input 4	Input 3	Input 2	Input 1

Energy level hardware selection is from inputs 1 to 3 state (only even values can be selected):

Parameter	ENERGY_HSEL_3	ENERGY_HSEL_2	ENERGY_HSEL_1	ENERGY_HSEL_0
Selection	Input 3	Input 2	Input 1	0

Energy level hardware selection can be 4, 8, 12 and 16 selected from inputs 5 to 6:

Parameter	ENERGY_HSEL_3	ENERGY_HSEL_2	ENERGY_HSEL_1	ENERGY_HSEL_0
Selection	Input 6	Input 5	0	0

5.11   ADDRESS HARDWARE SELECTION

Address hard sel. 0 and Address hard sel. 1 registers set the combination of inputs that will generate the hardware selected address (**HW sel add**).

5.11.1   SELECTION EXEMPLES

Energy level hardware selection is 1 to 16 from the optional selector:

Parameter	HSEL_7	HSEL_6	HSEL_5	HSEL_4	HSEL_3	HSEL_2	HSEL_1	HSEL_0
Selection	0	0	0	0	Sel bit3	Sel bit2	Sel bit 1	Sel bit 0

Energy level hardware selection is (1 to 16 from selector) + (16 if input 1 is active) + (32 if input 2 is active):

Parameter	HSEL_7	HSEL_6	HSEL_5	HSEL_4	HSEL_3	HSEL_2	HSEL_1	HSEL_0
Selection	0	0	Input 2	Input 1	Sel bit3	Sel bit2	Sel bit 1	Sel bit 0

5.12   RESET ON FAILURE

In case of failure, Sx-IP will try to resume by issuing a software reset.

The time from the failure apparition to the software reset is configurable by writing the **Reset on failure** register.

If the **Reset on failure** registers' value is 0, the reset on failure function is disabled.

5.13　HEALTH MONITORING

Sx-IP device has a build in configurable health monitoring function.

It allows to detect when a device regularly miss flashes, that is relevant of a flash tube end of life.

Health monitoring algorithm is bases on **Missed flash weight** and **Health threshold** registers' values.

5.13.1　HEALTH MONITORING ALGORITHM

The algorithm is:

- Each missed flash **Health indicator** register is incremented by **Missed flash weight**.
- Each succeeded flash **Health indicator** register is decremented by **1** (if not zero).
- If **Health indicator** reaches **Health threshold**, a flash failure is triggered

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Design notes:

*Setting **Health threshold** to zero inhibits triggering a flash failure.*

Flash health evolution laws and failure thresholds are factory configured. It can be adapted to client needs.

Default values are 1000 for MISSED_FLASH_WEIGHT and 1000 for HEALTH_THRESHOLD. It allows 10 missed flashes every 10 000 flashes.

5.13.2　HEALTH MONITORING SET-UP

Health monitoring algorithm allows to adjust the health monitoring based on two parameters:

- The maximum allowed consecutive missed flashes; subsequently called **CMF**
- The maximum allowed missed flash rate; subsequently called **MFR**

Health monitoring registers' value can be calculated using following equations:

Missed flash weight = 1 / MFR

Health threshold = (CMF + 1) * **Missed flash weight**

Calculation example:

Let's assume that we want the flash failure to trigger if the missed flash rate rise above 1% or if more than two consecutive flashes are missed:

- Expected CMF = 2 consecutive flashes
- Expected MFR = 1%

Missed flash weight = 1 / 1% = 100

Health threshold = (2+ 1) * 100 = 300
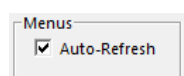
6 SUPERVISION REGISTERS

Supervision registers are in read only.

6.1 SUPERVISION REGISTERS OVERVIEW

First column is the register's name

Colored column is the explain registers' content

On the last row, READ button allow to read all registers in a single operation

Menus
☑ Auto-Refresh

If the Auto-Refresh option is ticked, supervision registers are read with one second period

Supervision registers	
Soft Id	SxIP 2.02
Reset source	Software
Modbus address	1
Input voltage	13.97V
Min Input voltage	13.44V
HT voltage	270.0V
Temperature	26°C
Min and Max temp.	22°C 57°C
Flash power	0.00W
Fan speed	4560rpm
HW sel Add & Energy	1 0
Energy levels [1:4]	11 11 11 11
Ftimes [1:4]	218µs 218µs 218µs 218µs
Energy [1:4]	60.00J 60.00J 60.00J 60.00J
Target energy	0.00J
Flash Energy	0.00J
Glitch count	0
Was not ready count	0
Flash errror count	0
Health indicator	0
Start count	55
Time count	19min
Total time count	1069min
Flash count	0
Total flash count	6631
Flash tube count	6631
Read all registers	READ

6.2 SUPERVISION REGISTERS DETAIL

Soft Id: Device software identification and revision

Reset source: Last identified reset source

Modbus address: Device Modbus address

Input voltage: Input voltage measured after the input protection stage

Min input voltage: Minimum input voltage value seen since last reset

HT voltage: Voltage of the energy storage

Temperature: Internal temperature

Min and Max temp.: Minimal and maximal recorded temperature

Flash power: Actual flash power (10s average)

Fan speed: Fan rotation speed

HW sel Add & Energy: Values computed from the combination of hardware selection setting registers and inputs state

Energy levels [1:4]: Energy levels that are associated with each of the four logical triggers

Ftimes [1:4]: Flash times associated with each of the four logical triggers

Energy [1:4]: Energies associated with each of the four logical triggers

Target energy: Energy that was expected for the last flash

Flash energy: Last flash energy (measured)

Glitch count: Number of pulses detected on trigger inputs that did not last as long as the glitch filter time

Was not ready count: Number of flash requests that were cancelled because the flash was not ready

Flash error count: Number of flashes that were not conform (energy level not in the expected limits)

Health indicator: Tube health indicator (refer to 5.13)

Start count: Number of power-up cycles through the device life

Time count: Operating time since the last power-up

Total time count: Total device's operating time

Flash count: Number of flashes since the last power-up

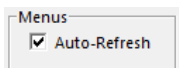**Total flash count**: Number of flashes in the device life

Tube count: Number of flashes since the last tube replacement

7 FLAGS REGISTERS

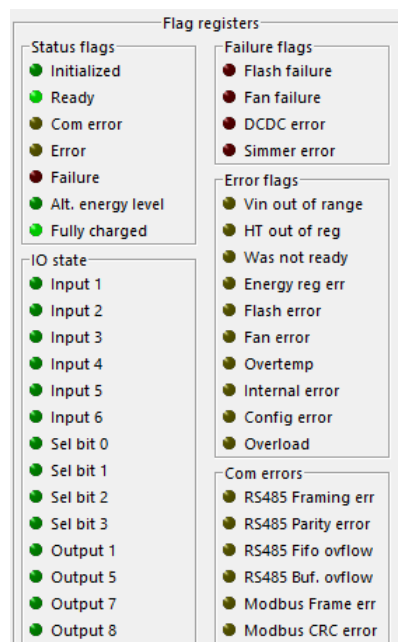Flag registers provide device state and errors

7.1 SETTINGS REGISTERS OVERVIEW

Flag registers are refreshed with the supervision registers

Menus
☑ Auto-Refresh

If the Auto-Refresh option is ticked, flags registers are read with one second period

7.2 STATUS FLAGS

Initialized: Set after reception of a **Set init done** command. It may be set in order to detect a device reset

Ready: The device is ready to flash

Com error: Communication error on the Modbus link

Error: Set in case of error

Failure: Set in case of failure

Alt. energy level: The alternate energy levels are active

Fully charged: The internal energy storage has reach its regulation point

7.3 IO STATE

Give the state of device inputs and outputs. Alighted when the input / output is in active state.

7.4 ERROR FLAGS

Vin out of range: Set if the input voltage has been out of range in the last 10 seconds

HT out of reg: Set if the device fails in reaching the energy storage regulation point.

Was not ready: Set is flash request occurs while the flash was not ready

Energy reg err: The energy regulation algorithm reaches one of its flash time limits

Flash error: Last flash was missed or out of expected energy range

Fan error: Internal fan is not spinning at expected speed

Overtemp: Internal temperature exceeds over-temperature threshold (80°C with 2°C hysteresis)

Internal error: An internal error occurs (details available from **Internal errors** register)

Config error: Some value in settings is not supported (details available form **Configuration errors** register)

Overload: The average output power overpass the limit (50W)

7.5 FAILURE FLAGS

Flash failure: Flash error occurrences exceed defined health parameters

Fan failure: Internal fan was in error for 10s

DCDC error: An over-voltage condition occurs on the internal high voltage supply

Simmer error: Unexpected ignition of the flash tube

7.6 COM ERRORS

RS845 Framing error: A received frame was not correct (UART frame level)

RS485 Parity error: A received frame comes with bad parity

RS485 Fifo ovflow: More characters were received that the FIFO can hold

RS485 Buf. ovflow: A character was received before last frame was processed

Modbus Frame err: A frame was received with unexpected size

Modbus CRC error: A frame was received with a bad CRC

8   COMMANDS

Commands sections allow to send commands to the device

Reset: Software reset the device

Set init done: Set the initialized flag (refer to §7.2)

Clear: Clear errors flags and counters

Flash: Software flash request

Save settings: Save settings registers in non-volatile memory

Clear tube count: Reset the flash tube flash counter

Commands
Functionnal
Reset
Set init done
Clear
Flash
Save settings
Clear tube count