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Activation of the illumination control card via SAIA-SBUS and MODBUS

TIC 15s V. 2.10 TIC50SD V. 3.05

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1. Introduction

In this document is described how the illumination control card gets configured and how it is accessed via S-BUS or via MODBUS. This document contains also a summary of the different lamp types.

2. Requirements

This concept was compiled along the following principles:
- It is one of the main targets to access the illumination control device with a SAIA SPS as simple as possible. The communication efforts should be as low as possible. It is also possible to use the univeral MODBUS.

- The address of the electronic card, the cardt ype and the type of lamp are stored on the backplane in the EEPROM. This applies also for the values as illumination intensity in the emergency usage (day and night). The parameters are protected with a check sum CRC and stored twice.

- The control card knows what kind of illumination control type it is. Due of this attribute, the card can verify wether or not it is located at the right place in the backplane.

- The illumination control cards can be exchanged without submission of any additional setups.

- The illumination control card is ruled simply by a register. In this register the brightness gets definded.

- In regular intervals, the status has to be requested from the master (SPS). In this register, upcoming failures are forwarded.

- Besides of this two main registers further registers are accessible for the initialisation and general information.

3. Activation via S-BUS and MODBUS

3.1. Used S-BUS commands

From the S-BUS protocol only two different commands are used:

Transmit Integer (0x0E)
Setting up of one or several input registers on the control card. The input registers have a longitude of 32 bits. With one command several consecutive registers can be set up, (can be used for initialisation of the card after a reset command).

Receive Integer (0x06)
Reading of one or several registers in the control card. The output register hava a format of 32 bits. With one command several consecutive registers can be read.

3.2 Activation via the MODBUS

3.2.1 Implemented MODBUS Protocol

Implemented MODBUS protocol
In the illumination control device there is only one **MODBUS ASCII-Mode** implemented for the moment being. The ASCII-Mode has the ability for the transmission via Ethernet or via some modem connection. The setting up of the serial interface is fixed **7 bytes of data** and **even parity**. The transmission speed (Baud-rate is selectible).

3.2.2 Used MODBUS commands

From the MODBUS protocol only two different commands are used:
Read Holding registers (0x03)
Reading from one or several registers of the illumination control device. The output registers have a longitude of 16 bits. With this command several consecutive registers can be read. There will always be a minimum of two registers to be read.

Preset multiple registers (0x10)
Setting up of several input registers on the illumination control device. The imput registers have a longitude of 16 bits. With one command several consecutive registers can be set up. Always a minimum of two registers is read.

3.2.3 Register definitions for the MODBUS

The registers of the control device (S-BUS) comprieses 32 bits. The MODBUS is defined for 16 bits registers. Always two MODBUS registers comply with one register of the control device.

MODBUS_Register1 = S-BUS_Register*2
MODBUS_Register2 = S-BUS_Register*2 + 1

Example 1:
Setting up of the control device targeted performance with a target performance 1000.
Register number in the control device and in the S-BUS: 1
The register with the address 1 corresponds in the MODBUS environment to the registers with the addresses 2 and 3.

Command MODBUS:	16	
Starting address:	2	
No of registers:	2	
Value of register 2:	0	//16MSB
Value of register 3:	1000	//16MSB

Example 2:
Reading of controller status and controller performance.
Register numbers in the controller and in the S-BUS: 4,5
The registers with the addresses 4 and 5 correspond in the MODBUS environment to the registers with the addresses 8, 9, 10, 11
Command MODBUS: 03
Starting address: 8
No of registers: 4
Answer:
Value register 8: 16MSB controller status
Value of register 9: 16 LSB controller status
Value of register 10: 16 MSB actual controller performance
Value register 11: 16 LSB actual controller performance

3.3 Main register

Entrance register

Nr	Name	Function
1	**Controller´s targeted performance**	Actuate the illumination control device performance in 0/00.0 > Means controller off. The minimal performance depends from the selected lamp type. Is the controller´s targeted value this value, then it corresponds to the minimal performance

This register can also be read.

Output register status

Nr	Name	Function
4	**Controller status**	Controller status as number of errors 00 means no error otherwise status corresponds to the lists of failures.
5	**Controller performance**	Actual performance output of the controller
6	**Controller status flags**	Controller status as flags 00 means no errors otherwise status corresponding to error list (flags)
7	**Controller mode**	Status of the controller 0 status OFF means waiting until power is switched on on the card. 1. Status pre-heating waits until the lamp is preheated (mode “preheating”).

		2 Status STARTUP until the lamp is triggered. 3. Status HEATING UP Wait until the point of time where the lamp is heated up enough. 4. Status REDUCING OF PERFORMANCE The performance of the controller gets reduced. 5. Status PERFORMANCE STABLE performance of the controller is stable 6. Status INCREASING PERFORMANCE performance of the controller gets increased. 7. Status POWER FAILURE Treatment of the failure 8. Status WAITING FINISHED Waiting until the off-time is over an the lamp can get started again. 9. Status FAILIRE OFF The number of triggering trials is exhausted. Only after a new switching on, the triggering voltage is activated and is switched on, in the way that at exchanging the lamp starts to make light
8	**Register tryal**	Number of unsuccessful triggering trials

3.4 Register for the initialisiation

After a hardware reset of the card, this card will indicate this RESET in the register control status. To abandon this status, the following configuration registers have to be set up.
The status reset vanishes if at least one of the registers is defined. The status does not vanish in case of unavailable or unadmissilbe values.
It is mandatory that all registers are set up for the targeted lamp types.

The registers can be described and read for controlling purposes. The value of the register will be stored in a internal EEPROM of the processor. After a reset command, the registers have from the beginning the same values as set up the last previous time.

Input register and output register

No	Name	Function
10	**Initialisation status**	Status of the illumination control device after a reset command or in case the communication with the master is interrupted.

		Is the initialisation status > 1000, the status of the controller after a reset will be on 0 (lamps extinguished). After the timeout of the communication, the controller remains on the same status as previously set. There will be no changement of the initialisation status.
11	**TimeoutCom**	It means the time after the initialisation status of the controller card has changed in case no communication has been possible. Time-Unit: 10ms
12	**IminLampeOn**	This means the minimal power that flows when the lamp is triggered. If this value gets not attained, a new triggering procedure is initialised. (mA)
13	**ImaxController**	It means the maximum power flow of the controller. In case this value is exeeded, the performance gets reduced and a failure is signalized. (mA)
14	**MaxTemp/Controller**	It means the maximum temperature of the controller in case this value gets larger, the performance will be reduced and a failure will be signalized.

Register for the CEAP-Digi-Bus

Those registers are only needed in case that the controller works in the CEAP-Digi-Bus mode.

No	Name	Function
15	**Adaption interval of sent data**	The transmission rate of the CEAP-Digi-Bus commands in seconds. 0 > Command is only sent in case of a changement of the performance. 2...255 intervals in seconds. Example: Value 10 Every 10 seconds the actual performance will be sent via the BUS.
16	**Adapt VoutRise time**	This value will be sent further on to the receiver. In case the performance will be changed, the exit will be adapted in a delay time. 0 > without delay time 255 means maximum delay

3.5 Registers with general informations Output register

20	**HWIdBoard**	Id of the hardware of the corresponing slot. Each type of insertion has another Id
21	**HWIdBackplane**	It means the identity of the hardwar of the backplane. Each type of insertion has another Id. After a reset command, the card controls automatically that the both hardware Ids are identical. If this is not the case, a failure will be announced.
22	**SWFunctionId**	Each type of lamp has its own Id. The Id is destined by the functions of the required performance. The software function Id will be stored on the EEPROM of the backplane.
23	**SWVersion**	Version of the submittet software on the controller.
24	**Serial No**	Serial Number of the device. This number is submitted at the occasion of the product testing.
25	**PowerDay**	Performance of the controller card in case of a manual operation mode. (Day). Value will be programmed on the backplane.
26	**PowerNight**	Performance of the controller card in case of a manual operation mode. (Night). Value will be programmed on the backplane.

3.6 Register Power and temperature for tests

Supported by the following registers, the power and the temperature of each register can be inquired. This register serves mainly for tests of the controller card and for the search of failures.

Output register

No	Name	Function
40	**ControllerPower**	Power of the controller in mA (approached value).
41	**TempController**	Temperature of the control device in centigrades.
42*	**Ueff**	Voltage at the output in Volts (actual value)
43*	**U max**	Voltage at the output in Volts (peak value)

Only controllers of the type 0x25 and 0x26

3.7 Failure messages

L.P	Priority	Bit*	No*	Short designation	Description
1	1	BIT23	11	**HW_KO;P_ERR**	Wrong card type inserted (No. of the HW on backplane differs from the number of the insterted module)
2	2	BIT22	10	**NO_LAMPFUNC_ERR**	Lamp type on the backplane is unknown
3	3	BIT21	9	**SYNC_ERR**	No regular syncronisation impulse. Net voltage does not arrive or is heavely disturbed.
3	3	BIT20	8	**NO_CURRENT_ERR**	There ist no power flow in the controller.
4	4	BIT19	7	**CURRENT_TO_HIGH_ERR**	Current is to high, performance has been reduced.
5	5	BIT18	6	**TEMP_ERR**	Temperature of the control device is too high. The performance has to be reduced.
6	6	BIT17	5	**RESET_ERR**	Card has executed a reset and is in the initial status. This message disappears if the inital data are setup correctly.
7	7	BIT16	4	**INI_PARA_ERR**	The initalised data after a reset are invalid (out of the targeted area). Disappeares when the initial data are set up

					correctly
8	8	BIT15	3	**NO_VALIDPOWER_ERR**	Invalid parameter, controller in a targeted status.
9	9	BIT 14	2	**COMMTIMEOUT_ERR**	The timeout for the communication is over. The card is in the status of initialisation. If the controller goes over to a targeted status the failure message will be extinguished.
10	10	BIT13	1	**MANUALMODE**	The controller will be ruled manually with the digital inputs. The setup for targeted values are invalid.
11	11		0	**OK**	No failure occuring

* Falue in the register = **controller status**
** Bits in register = **controller status flags**

3.8 Status LED (starting at version 1.04)

The status of the LEDs will be set along the internal variable controller modes.

Pos	Status of the controller **ControllerMode**	Blinking pattern
1	1. Pre heating 2. Starting up 3. Heating up 4. Reducing of performance	**LED flashes impuls 1/3 of the Period time** (performance will be reduced)
2	5. Stable performance	**LED shines** (performance stays stable)
3	6. Increasing of the performance	**LED flashes puls during 2/3 of period time** (performance gets increased)
4	7. Power failure 8. Waiting OFF 9. Failure OFF	**LED flashes 2x "pulse", than intermission** (controller has a power failure)
5	0. OFF	**LED remains dark** (controller is switched off)

4. Hardware-ID

Controller insertion slide-in

LP	SW Functionload	Card type
1	0x10	Controller card 15A for backplane with RC element over Triac (power supervision in the control circuit)
2	0x11	Controller card 15A for backplane without RC element over Triac (power supervision in the relays circuit)

Controller 50A

LP	SW Functionload	Card type
1	0x20	Controller 50A autonomous with RC element over Triac (power supervision in the controlling circuit)
2	0x21	Controller 50A autonomous without RC element over Triac (power supervision in the relays circuit)
3	0x22	Controller 50A autonomous (power supervision in the controller circuit) Printed circuit version with Hex switch on print
4	0x25	Controller 50A autonomous with SD Card and voltage measurement (Power supervision in the controlling circuit)
5	0x26	Controller 50A autonomous with SD card and voltage measurement (Print version with Hex switch on controller print 50A autonomous
6	0x27	Controller 50A autonomous with SD card and voltage measurement RS-485 Bus not active, instead of this, a failure exit on X3/PIN1 (Port PE1)

5. Lamp types

The controller can access different lamp types. Depending on lamp type, its caracteristics are also different.

Functions
- Power supervision of the lamps
- Automatic execution of the start-up. (Start-up algorithm)
- Automatic restarting when lamps switch off (restarting alogrithm)
- Delayed controlling, e.g. decreasing of the performance (controlling algorithm)
- Reducing of the performance in case of power or temperature excess
- Generation and transmission of failures

The function type of each lamp will be stored in the EEPROM of the backplane. At the occasion of operation starting. (Refer: Register software function load).

5.1 NaH lamps

Hardware-ID: 0x10, 0x20

LP	SW Function load	Lamp type	Algorithm description
1	0x20 01 01	1 Type Standard algorithm for NaH-lamps	Tunnel transition

5.2 Light emitting tubes with a special electronic pre-switch

Hardware ID: 0x11, 0x21

LP	SW Funtion load	Lamp type	Algorithm description
1	0x20 02 01	1 Type	Standard algorithm for light emitting tubes

The pre-switch accepts the performance for the tubes via 230VAC. This voltage will be switched by the relais on the print. In case a bigger number of tubes has to be controlled, the voltage must be conducted over an additional interruptor. The light emission of this pre-switch will be set up by a AC voltage from 0....200VAC. This voltage will be generated by the Triac.

The power of the lamp will be not be supervised in case of this application.

5.3 Light emitting tubes with adaption electronic from 0 to 10 Volt (Strasser patent)

Hardware-ID: 0x11, 0x21

LP	SW function load	Lamp type	Algorithm description
1	0x20 02 02	1 Type	Algorithm for adaption device Delay angle **0 to 30° degrees: performance is 100%** **30 to 130° degrees: 100% down to -0% performance** (> 145 degrees: full performance)

With the controller, the pre-switch device will be alimented and controlled. It generates in dependence to the delay angle a control voltage from 0 to 10 Volts for usual pre-switches.
The pre-switch accepts the performance for the light emitting tube via 230VAC. This voltage will be switched by the relays on the printed circuit. In case a bigger number of light emitting tubes has to be operated, the voltage has to be switched by a additional interruptor.

The Lamp power will not be supervised at this application.

5.4 Bulps or sone other R-load

Hardware ID: 0x10, 0x20

LP	SW Functionload	Lamp type	Alogrithm description
1	0x20 03 01	1 Type	Standard algorithm for bulps

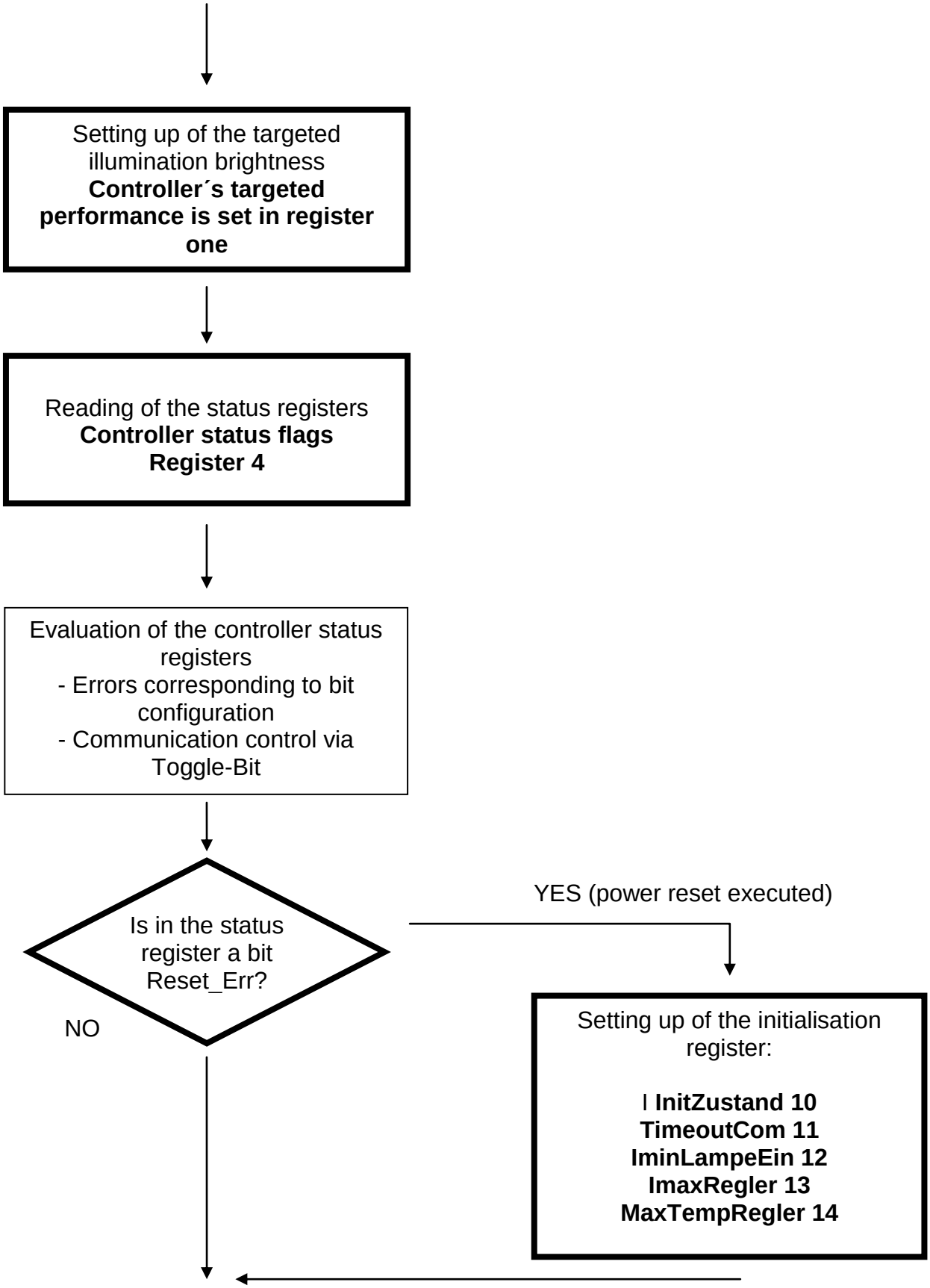
5.5 CEAP-DIGI-BUS for the digital controller (Strasser Elektronik 1..10V)

In this mode the controller opperates as a data sender for the CEAP-DIGI-BUS

LP	SW Functionload	Lamp type	Alogrithm description
1	0x30 01 01	1 Type	Algorithm for the adaptions device CEAP-DIGI-BUS

6. Implementation example

In practice, the following kind of implementation of the software on the controller side has been established. In this kind of implementation there will be only one register set at each communication cycle and only the registers have to be read.
If in case the controller has executed a power reset, the initialisation registers are set up again. If in case in a device a controller is exchanged, the new controller will be initialised the right way automatically due to this function.


Setting up of the targeted illumination brightness **Controller´s targeted performance is set in register one**
Reading of the status registers **Controller status flags Register 4**
Evaluation of the controller status registers
- Errors corresponding to bit configuration
- Communication control via Toggle-Bit
Is in the status register a bit Reset_Err?
YES (power reset executed)
NO
Setting up of the initialisation register:
InitZustand 10
TimeoutCom 11
IminLampeEin 12
ImaxRegler 13
MaxTempRegler 14
Communication with the adjacent controller