IMGPIA

Revision 1

Hardware Reference Manual – P – Version 1.3

Made in Germany

By

E.E.P.D. Electronic Equipment

Produktion & Distribution GmbH

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Reshipment / Return

Please remove all connections and peripheral devices when returning the module to the manufacturer. Use an appropriate packaging to protect the module during transport.

Packaging

In order to avoid damage in transit the module has been shipped with a protective packaging. The packaging is made of recyclable materials which should be recycled.

Proper Disposal

At the end of its life, dispose the device properly.

Table of contents

Preface

Read this first

About this guide this manual describes the IMGPIA module; its goal is to describe the module, how it works, how to integrate it and how to use it.

Safety First

DANGER	The red Danger sign warns you when a wrong or missing action dramatically endangers your life or health. The used components as well as the peripheral components could be destroyed.

WARNING	The orange Warning sign warns you when a wrong or missing action could seriously harm your health or destroy the used components.

CAUTION	The yellow Caution sign warns you when a wrong or missing action could damage the component.

ESD

The yellow ESD sign draws your attention that static-sensitive parts of the component could be destroyed. Unpack shielded components only with ESD protections like an ESD wrist strap.

The E.E.P.D. Note gives you more information and advice for optimal use of this product.

For example it helps you to purchase necessary or optional accessories.

1   Ordering Information

1.1   Available Modules

Ordering Number	Function	Connection	Color	Pinout see Tab 2
IMGPIAA0	GPI and GPO	direct connection	gray	GPIO connector
IMGPIAA30	GPI and GPO	direct connection	magenta	GPIO connector
IMGPIAC0	GPI and GPO	cable connection	gray	GPIO connector

Tab. 1: Available Modules

2 Installation and Operation

2.1 System Information

2.1.1 Required tools

No tools are required for a standard connection or DIN rail mounting. However, a module protection is recommended for standard connections.

For a secure mounting on the optional module holder from E.E.P.D. we recommend following tools:

- Module holder: cross-headed screwdriver

Further required tools depend on mounting type and place.

2.1.2 External documents

Please note also external mounting and user manuals.

2.1.3 Technical support

For technical information about hardware or software please contact 'sales@eepd.de'.

2.1.4 Installation and connection regulations

WARNING	**Please follow all safety instructions at the place of installation.**
	Please ensure that during installation no voltage is applied.
	Please ensure that during mechanical installation no cables are connected.

2.1.5 Scope of supply

Please check before installation that all required parts are complete:

- 1x IMGPIA-USB-module

- 1x cross-headed screw

- Hardware Reference Manual

- Driver CD-ROM

2.1.6 System characteristics – usage

The IMGPIA-module allows a system extension to a Molex 26 pin MicroClasp™ via USB port. Especially in industrial environments, many technical devices use this GPIO-interface. Via the USB-module, various I/Os can be connected according to the IEC61131-2 standard. 8 inputs and 8 outputs are available.
The GPIO module enables condition monitoring and switching of actuators. The behavior can be freely determined by logical programming. The adapter can be flexibly connected to your system via Plug & Play. Power is supplied by USB. The module has 16 status LEDs. Due to the compact design with integrated DIN rail mount, the GPIO adapter is ideally suited for switching and monitoring digital inputs and outputs as well as analog inputs.

2.2 Mounting solutions

2.2.1 USB port installation

If the installation site permits, the USB-adapter-module can be plugged into any standard USB 3.0/2.0/1.1 Type A socket.

CAUTION	**To avoid mechanical stress on interfaces, we recommend a safe module holder.**

	The full range of functions depends on the respective USB port.

2.2.2 DIN rail mounting

The USB-adapter-module is designed for mounting on a TS35 mounting rail (DIN rail). The following procedure is recommended for insertion and removal.

Insertion:

Hang the module on the clip lock in the mounting rail, push it in the direction of the USB plug and snap it into the rail.
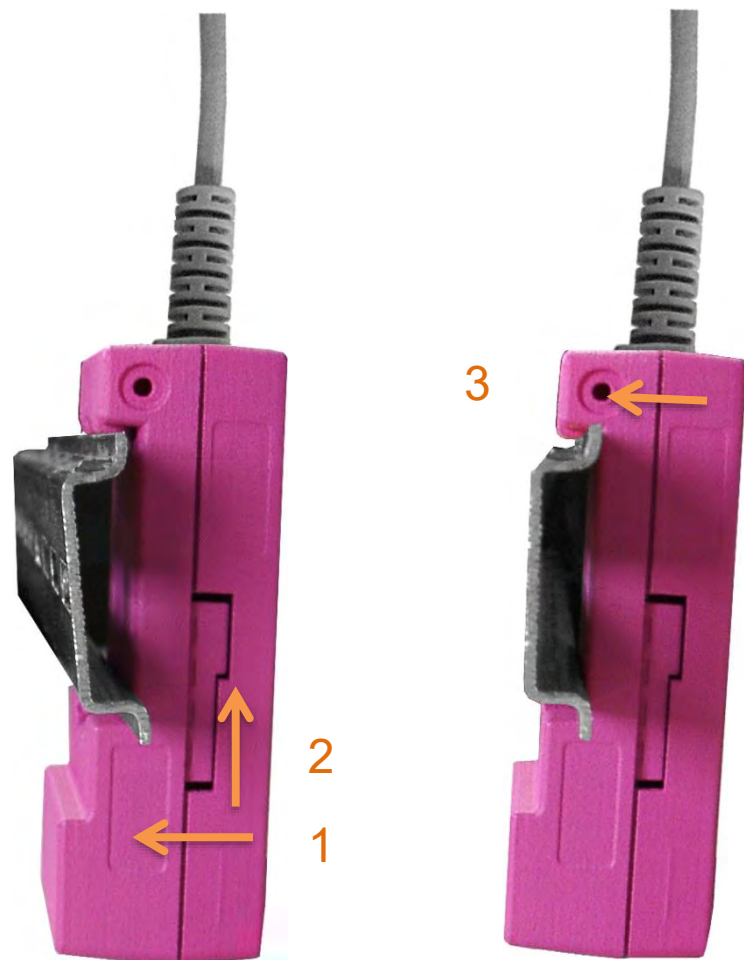
Fig. 1: Module Mounting

Removal:

Push the module in the direction of the USB connector, move it away from the rail and remove it.
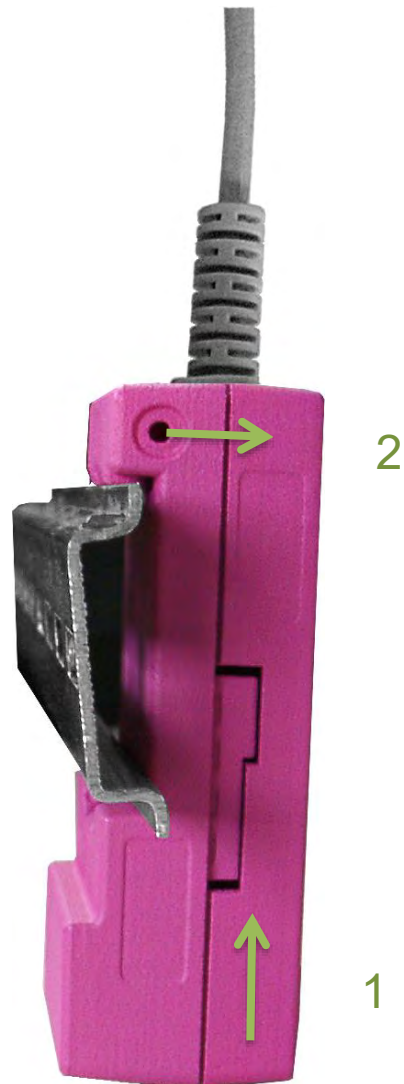
Fig. 2: Module Disassembly

2.2.3 Mounting on E.E.P.D. module carrier

The USB-module is particularly suitable for connection to a
TB-H USB hub, as well as to a TB-M from E.E.P.D..
The mounting profile offers space for seven USB modules, to
mount them easily and stable. Insert the USB module into the
guide of the respective slot and push it back to the stop. Secure
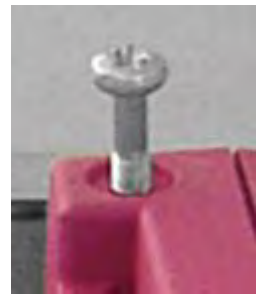the module with the enclosed screw.

Fig. 3: Module Carrier

Fig. 4: Screw

2.3   Initial Operation

Commissioning is easy. As soon as the USB module is connected to the USB connector of your system for the first time, your operating system usually automatically searches installs the necessary drivers. However, you can also install / update these from the 'Drivers'-folder on the supplied driver CD-ROM.

For your information please also read the README-file provided on the CD-ROM.

The wiring and operation of connected systems of external companies can be found in their documentation.

The dialog with the module takes place by means of simple commands in ASCII code and can usually be realized from any application, among others with a terminal program, by accessing the serial interface, it may be necessary to install the appropriate driver for the respective operating system. These are on the supplied CD-ROM.
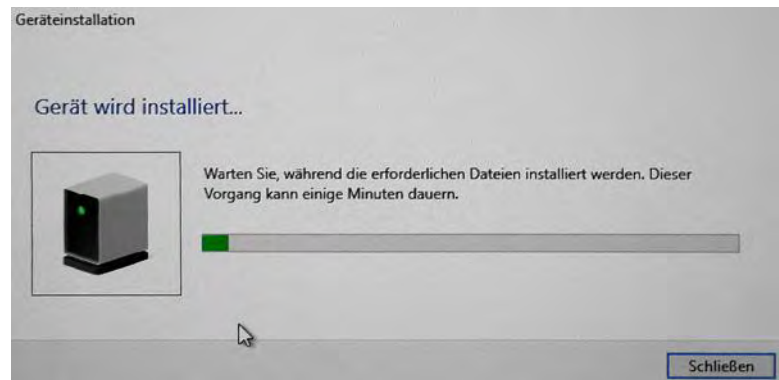

Fig. 5: Installation Screen

3   Product Description

3.1   Features

Power Supply

USB VCC (+5 V supply, current limited to 500 mA)

GPIO Connector

8 general purpose open-drain outputs with 0.5 A current capability

8 general purpose inputs conformable to DIN EN 61131-2

USB Client Port

1 USB 2.0 type A

Cable option available

OS Support

Linux Kernel 3.4 or later

Android

Microsoft® Windows® 7

Microsoft® Windows® 8

Microsoft® Windows® 10

Housing

ABS-PC

Cooling

Designed for fanless operation.

Conformity

CE, ROHS, REACH

Dimension

93 mm x 38.5 mm x 26.6 mm

Weight

Approximately 40 grams

Mounting

EMTrust TB-M and TB-H module mounting or

Hat rail mounting

3.2 Environmental Specification

Max. Operating Temperature

-40°C to +85°C ambient

Other operating temperature ranges upon request

Max. Storage Temperature

-40°C to +85°C

Max. rel. Humidity for all versions

95% @ 40°C Non-condensing

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3.3   Detailed Technical Specification

3.3.1 Embedded Controller

Microcontroller Microchip PIC24FJ64GB106 TQFP for the following main functions:

- USB virtual Com port

- USB HID device

- Control GPIOs

- Control LEDs

3.3.2 GPIO Voltage

- The absolute maximum voltage on any input or output is 32 V.

3.3.3 GPI Parameters

- Input threshold value referred to DIN EN 61131 type 1.

- The logical state of an input is HIGH if the voltage at the pin is above 15 V.

- The logical state of an input LOW if the voltage at the pin is lower than 5 V.

- The logical state of an input is HIGH if the current at the pin is above 15 mA.

- The logical state of an input is LOW if the current at the pin is lower than 0.5 mA.

3.3.4 GPO Parameters

- 8 general purpose open-collector outputs with 0.5 A current capability.

- V_{out} low @ 500 mA = 160 mV

- The maximum current flow through one PGND pin of the connector is 2 A. It is recommended to use all PGND pins to avoid destruction of the connector.

- It is recommended to use an external protection circuit.

If a command like #w051! Is executed, the transistor connects the output to PGND. If a command like #w050! Is executed, the output has a high impedance.

3.4   Pin out description

3.4.1 GPIO Connector
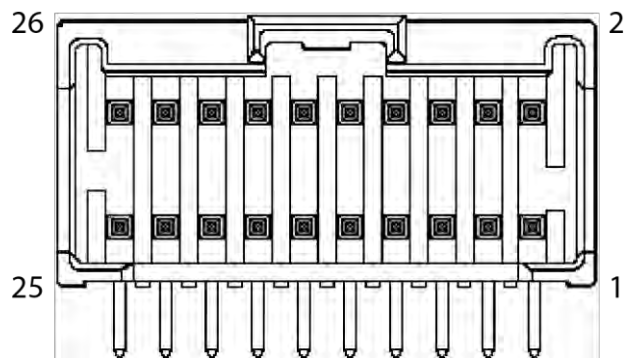

Fig. 6: GPIO Connector Detail

Fig. 7: GPIO Connector Schematic

Counterpart plug:

MOLEX 51353 MicroClasp™

Pin	Signal
1	GPO_1
2	GPO_5
3	PGND, for GPO
4	PGND, for GPO
5	GPO_2
6	GPO_6
7	GPO_3
8	GPO_7
9	PGND, for GPO
10	PGND, for GPO
11	GPO_4
12	GPO_8
13	VCC, derived from USB max. 500mA
14	GPO_VIN
15	GND
16	GPI_13
17	GPI_9
18	GPI_14
19	GPI_10
20	GPI_15
21	GPI_11
22	GPI_16
23	GPI_12
24	ADC_1
25	AGND
26	ADC_2

Tab. 2: GPIO Connector

PGND: All PGND pins should be connected, even when not all GPO are used.

GPO_VIN: Max. reference voltage and protection for GPO, connect to VCC of Power Supply (max. 32V)
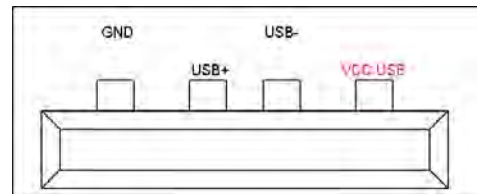
3.4.2 Single USB

Fig. 8: Single USB Detail

Fig. 9: Single USB Detail Schematic

Pin	Signal
1	VCC_USB
2	USB_N
3	USB_P
4	GND

Tab. 3: Single USB Connector

There is a cable option available for the USB port:

Fig. 10: USB Cable Option

3.4.3 Internal USB Molex Connector
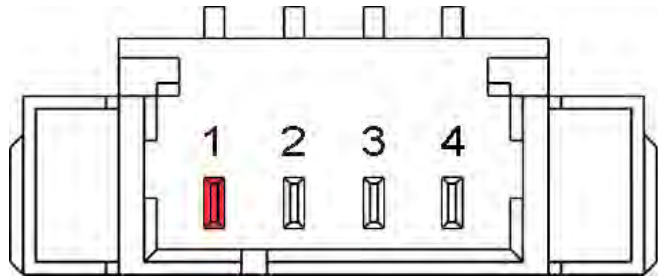

Fig. 11: Internal USB Molex Connector Schematic

Counterpart plug:

MOLEX Pico Blade 0510210400

Pin	Signal
1	VCC_USB
2	USB_N
3	USB_P
4	GND

Tab. 4: internal USB Molex connector
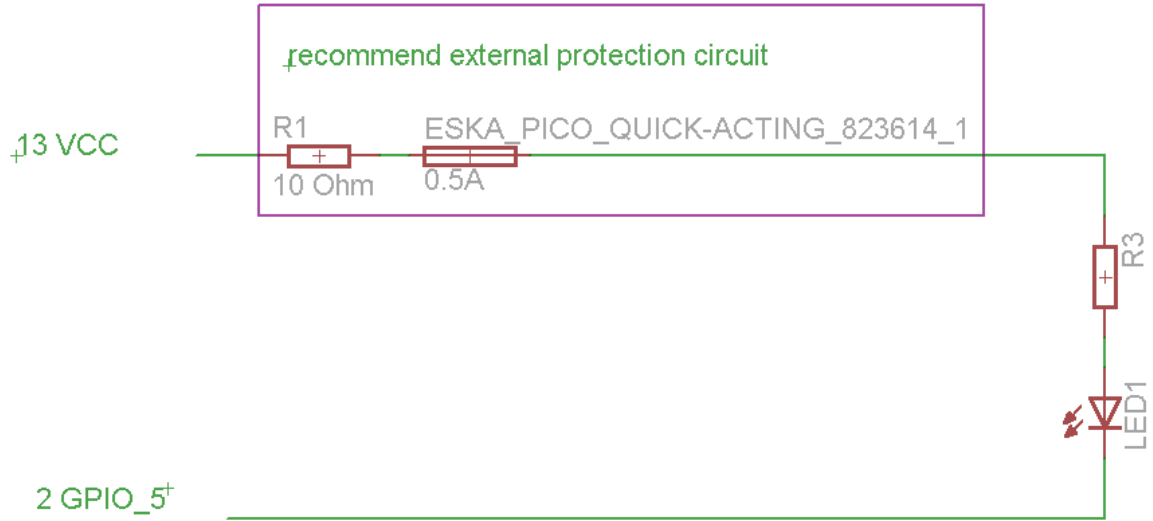
3.5   Connection examples
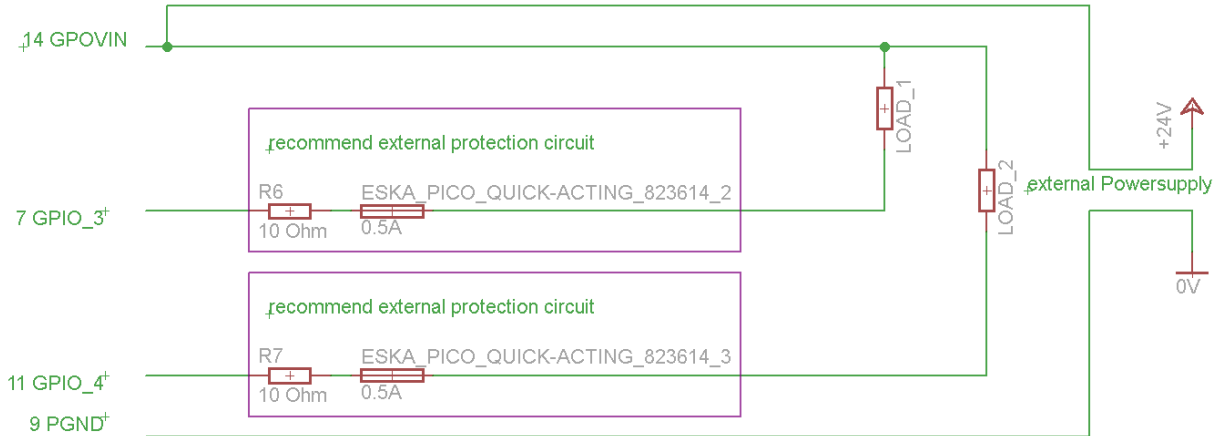

Fig. 12: Connect a LED
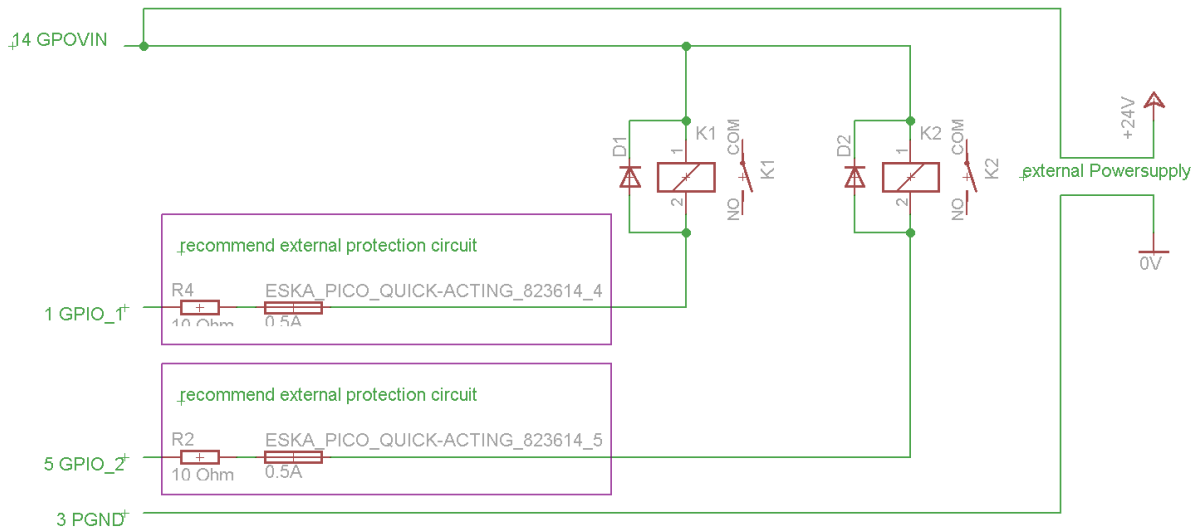

Fig. 13: Connect resistive Load

Fig. 14: Connect inductive Load

CAUTION ⚠	**When using inductive load, it is highly recommended to connect a recovery diode. Connect always GPOVIN to avoid stress peaks at the GPIO Card.**

4   Software

Send ASCII signs to the COM Port. Baudrate doesn't matter.

Field	Length of Field	Possible Character	Description
1	1	#	beginning of a command
2	1	c, w, r, l	c -> config w -> write to port r -> read from port l -> write to LED (1 – on, 0 – off)
3	2	lb, hb, 01, 02, …15, 16, an, sn, sb, fl, im, hw, fd, a1, a2	lb -> use low byte (GPO/LED 1 - 8) hb -> use high byte (GPI/LED 9 - 16) a1 -> analog input adc 1 a2 -> analog input adc 2 01 -> use GPO 1, LED 1 … 08 -> use GPO 8, LED 8 09 -> use GPI 9, LED 9 … 16 -> use GPI 16, LED 16 an -> Adapter number (3 characters 000 – 255 ('0' – '9' allowed only) sn -> Serialnummber (15 characters) sb -> firmware small boot block revision fl -> firmare loader revision
4	0-8	1 0 i n s o, 00000000, 00000001, … 11111111 pt001600, pt001601 … pt065536 ot000000, ot000001… ot065536 pt001600ot065536 cn db000001… db065536 db000000	1 -> set output, LED on 0 -> clear output, LED off i -> use pin as input (without debouncing or change notification) n -> non-I/O synchronized, independent LED control s -> I/O synchronized LED control o -> use pin as output (without PWM) pt -> change PWM period time [1/16 µs] (244,14 Hz ≤ f ≤ 10 kHz) ot -> change PWM on time [1/16 µs] pt, ot -> enable PWM with period pt & on time ot cn -> get a change notification if the intput pin changes its value db -> debounce input pin and set debounce time [ms] 0 – means debouncing is off
	1	!	end of command

Tab. 5: Field Descriptions

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Command	Answer	Description
#c01o!	-c01o-OK	Configure GPO 1 as output without PWM
#clbo!	-clbo-OK	Configure all outputs (GPO 1 - 8) without PWM
#chbi!	-chbi-OK	Configure GPI 9 - 16 as input without debouncing and change notification
#clbi!	-clbi-ER	Error: GPO 1 – 8 are outputs only!
#chbo!	-chbo-ER	Error: GPI 9 – 16 are inputs only!
#c10i!	-c10i-OK	Configure GPI 10 as input without debouncing and change notification
#clbn!	-clbn-OK	Configure LED1 - 8 as non-I/O synchronized LED's
#c01n!	-c01n-OK	Configure LED1 as non-I/O synchronized LED
#l021!	-l021-OK	Switch LED 2 on
#ra1!	-ra1=5.2V-OK	Read analog input 1, value = 5.2V
#wlb01000001!	-wlb01000001-OK	Clear all outputs, set output 1 and 7
#w051!	-w051-OK	Set output 5
#w050!	-w050-OK	Clear ouput 5
#r13!	-r13=1-OK	Read input 13, (the input pin was high)
#r13!	-r13=0-OK	Read input 13, (the input pin was low)
#rhb!	-rhb=01000000-OK	Read highbyte (input pin 15 was high, the others are low)
#rlb!	-rlb=01000000-OK	Read lowbyte (output pin 7 was high, the others are low)
#ran!	-ran=053-OK	Read adapter number of the device (the number is "53")
#wan125!	-wan=125-OK	Write adapter number to "125". The number of writes are limited due to Hardware (≈1000). Use with care! The serial number must have 3 characters ('0' – '9' allowed only).
#c09db012312!	-c09db012312-OK	Configure debouncing on GPI 9
#chbdb001000!	-chbdb001000-OK	Configure debouncing on GPI 9 – 16 (1 sec)
#c09cn!	-c09cn-OK	Activate change notification on GPI 9
#chbcn!	-chbcn-OK	Activate change notification on GPI 9 - 16

#cfd!	-cfd-OK	Set all back to factory defaults
		  - all outputs no PWM & set to 0 (off).
		  - all inputs have no debouncing
		  - auto input pin change notification is off for all input pins
		  - all LED's are I/O synchronized controlled

#c03pt065536!	-c03pt065536-OK	Change PWM period for GPO 3 to 65536, pt has to have 6 characters ('0' – '9' allowed only)
#c03ot031234!	-c03ot031234-OK	Change PWM on time for GPO 3 to 31234 ot has to have 6 characters ('0' – '9' allowed only)

#c04pt065536ot032768! #clbpt065536ot032768!	-#c04pt065536ot032768-OK -#clbpt065536ot032768-OK	Set both period and on time for GPO 4 or Set both period and on time for GPO 1 - 8 with one command (to avoid glitches) and activate PWM. (here frequenz is 244,14 Hz & duty cycle is 50%) Note: - In current FW version - ot & pt have to be ≤ 65536! - if ot ≥ pt then output is always on (1)
#c03ot032768pt065536!	-#c03ot032768-??	No valid command – set pt first!
#rsn!	-rsn=abcdefg12345678-OK	Read Serialnumber (the number is abcdefg12345678)
#wsn!	-#wsn-??	No valid command - serial number can only be read
#rsb!	-rsb=1.2.3-OK	Read Firmware Revision Small Boot Block (major.minor.engineering)
#rfl!	-rfl=2.3.4-OK	Read Firmware Revision Firmware Loader (major.minor.engineering)
#rim!	-rim=3.4.5-OK	Read Firmware Revision Image (major.minor.engineering)
#rhw!	-rhw=1.1.1-OK	Read board's Hardware Revision (major.minor.engineering)
	-oflw=o:0x5-ER	Answer only: overflow - 5 bytes are missed in FW output queue (to FW)
	-oflw=i:0x10-ER	Answer only: overflow - 16 bytes are missed in FW input queue (from FW)
	-oflw=o:0x13i:0x200-ER	Answer only: overflow - 19 bytes are missed in FW output queue (to FW) and overflow - 512 bytes are missed in FW input queue (from FW)
#clb00001000!	-#clb00001000-??	No valid command
#kjhkjh	-#kjhkjh-??	No valid command
#rhb00000001!	-#rhb00000001-??	No valid command
#wan1234!	-#wan1234-??	No valid command
#wan12a!	-#wan12a-??	No valid command

Tab. 6: Examples

Set output means that the output transistor connects the output to ground. An uninitialized output is per default cleared.

5   Appendix

Revision History

Date	Version	Changes	Proofed to release
11.01.2019	1.0	First release	
16.01.2019	1.1	Software table adjusted	
30.01.2019	1.2	Public release	
31.01.2019	1.3	Connector pinout clarified	

Table of Figures

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