

I2C COMMUNICATION SPECIFICATION

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1 Revision history

Revision	Date	Change description	Change resp
A	2026-03-10	First revision, document created	SG
B	2026-10-21	Second revision, changed slave address & added endianness	SG

2 General

2.1 Scope

This specification covers the I2C communication for PDI board.

3 Physical layer specifications

3.1.1 Baudrate
I2C supports standard mode.

4 Register map

4.1 Overview

CMD address	CMDx Register	Description
0x1	Configuration A	Configuration of register
0x2	Configuration B	
0x3	Configuration C	
0x4	Configuration D	
0x5	Setting A	Set configuration of register
0x6	Readouts A	Read signals of register
0x7	Readouts B	
0x8	Calibration A	Set value for calibration
0x9	Calibration B	
0xA	Info A	Settings for general information

5 Communication protocol

5.1 Protocol description

Any transaction via I2C between the PDI and a master starts by addressing the PDI with a write command. After the write is acknowledged by the PDI the next byte written is a command byte that contains information on if the write command is intended to configure the PDI for a read or if we are to continue writing and what register address the operation is aimed for. The next byte written is then a bit for bit setting that specifies what sub registers (or bits) we want to access. After that any preparation for a read message is done and the next time a read is addressed to the PDI it will respond with the requested data. If the message is a write message it instead continues with the write data to the requested sub registers in sequence starting with the MSB addressed. The PDI receive and sends data in big endian

5.2 Example messages

5.2.1 Example write message structure

Start cond.	Slave Addr	CMD (8 bits)	Sub Reg addr (8 bits)	Data Frames (N*8 bits)	Stop

5.2.1.1 Example write message

The example message description starts after the PDI is addressed via I2C and is an example of a write to register 3, sub registers 7 and 6 (Normal voltage low limit and Normal voltage high limit). Since it is a write message, the CMD bits become 0x83, the sub reg addr becomes 0xC0 (bits 7 and 6 set) and the data frames of what to write follows.

CMD	Sub Reg addr	Voltage low (15:8)	Voltage low (7:0)	Voltage high (15:8)	Voltage high (7:0)
0x83	0xC0	0x03	0xEB	0x07	0x08

5.2.2 Example configure for read message structure

Start cond.	Slave Addr	CMD (8 bits)	Sub Reg addr (8 bits)	Stop

5.2.2.1 Example configure for read message

The example message description starts after the PDI is addressed via I2C and is an example of a configure for read of register 3, sub registers 7 and 6 (Normal voltage low limit and Normal voltage high limit)

CMD	Sub Reg addr
0x03	0xC0

5.2.3 Example read message

Start cond.	Slave Addr	Data Frames (N*8 bits)	Stop

5.2.3.1 Example read message

The example message description starts after the PDI is addressed via I2C and is an example of a read of register 3, sub registers 7 and 6 (Normal voltage low limit and Normal voltage high limit) (after the prior two examples have been sent)

Voltage low (15:8)	Voltage low (7:0)	Voltage high (15:8)	Voltage high (7:0)
0x03	0xEB	0x07	0x08

5.3 Command byte

Bit position	Description	Access
Bit 7	R/W	W
Bit 6	Reserved/not used	
Bit 5		
Bit 4		
Bit 3	Reg addr	W
Bit 2		
Bit 1		
Bit 0		

Bit 7 - (1) write access to register
(0) read access from register

Bit (6:4) - Reserved

Bit (3:0) - Address to access register

6 Register descriptions

Within a register. A sub register address might have bit field of different writeable bits. Within that bit address it contains another 8 writeable/readable bits.

6.1.1 Configuration A (register 1)

Bit address	Sub register Description	Access	Default value	Data Type
Bit 7	Configuration bits	R/W	N/A	u32
Bit 6-0	Reserved			

Configuration bits

bit 0: remote on/off polarity when set to one the PDI will assume module on when output is low.

bit 1: Enable Voltage output control

bit 2: Enable current control

bit 3: Enable voltage and current control (both at the same time)

bit 4: Enable module modbus communication (**not used**)

bit 5: Enable PG voltage alarm

bit 6: Enable Output voltage alarm

bit 7: Enable warning signal

bit 8: Enable module UART com (**not used**)

bit 9: Enable module PM bus com (**not used**)

bit 10: Use com for set values (**not used**)

bit 11: use com for current/voltage measurements (**not used**)

bit 12: use CB for current measurements instead of shunt

bit 13: write protect config, this bit must be set to 0 before changing any other configuration.

bit 14-31 Reserved for future use

6.1.2 Configuration B (register 2)

Bit address	Sub register Description	Access	Default value	Data Type
Bit7	I2C slave address	R/W	0x1	u8
Bit6	Max voltage on ref	R/W	0	u8
Bit 5	I2C reset	W	N/A	N/A
Bit 5:0)	Reserved			

Bit 7 - I2C slave address. Bits (15:7) do not use. Stored in a read only memory and change is made after a reset. Updated address is stored in flash memory.

Bit 6 – Maximum allowable voltage reference

Bit 5 – Reset I2C peripheral. Also updates address but does not store address in flash memory.

Bit (5:0) – Reserved

6.1.3 Configuration C (register 3)

Bit address	Sub register Description	Access	Default value	Data type
Bit7	Normal voltage low limit	R/W	0x0	u16
Bit6	Normal voltage high limit	R/W	0xFFFF	u16
Bit5	Current limit low warning level	R/W	0x0	u16
Bit4	Current limit high warning level	R/W	0xFFFF	u16
Bit3	Set temp int low warning level	R/W	-35	s16
Bit2	Set temp int high warning level	R/W	60	s16
Bit1	Set temp ext low warning level	R/W	-35	s16
Bit0	Set temp ext high warning level	R/W	60	s16

- Bit 7 - Set normal voltage low limit alarm
- Bit 6 - Set normal voltage high limit alarm
- Bit 5 - Set Current limit low warning alarm
- Bit 4 - Set Current limit high warning alarm
- Bit 3 - Set internal temperature low warning alarm
- Bit 2 - Set internal temperature high warning alarm
- Bit 1 - Set external temperature low warning alarm
- Bit 0 - Set external temperature high warning alarm

6.1.4 Configuration D (register 4)

Bit address	Sub register Description	Access	Default value	Data type
Bit7	Write parameters to flash	W	N/A	N/A
Bit 6	Restore parameters to default	W	N/A	N/A
Bit 5	Re-initialize I2C	W	N/A	N/A
Bit (4:0)	Reserved			

- Bit 7 - All parameters that have been written prior to a "save" command. Will have all written parameters stored to flash and loaded at consecutive bootups.
- Bit 6 - All parameters will be initialized to their default values.
- Bit 5 - Re-initialize I2C
- Bit (5:0) - Reserved

6.1.5 Setting A (register 5)

Bit address	Sub register Description	Access	Default value	Data Type
Bit 7	Relay digital output control	R/W	N/A	u8
Bit 6	Spare digital output	R/W	N/A	u8
Bit 5	Major fault relay control	R/W	N/A	u8
Bit4	Remote on/off	R/W	N/A	u8
Bit3	Current setpoint	R/W	50	u8
Bit2	Voltage setpoint	R/W	2	u8
Bit1	Set Fan speed PDI	R/W	N/A	u16
Bit0	Set LED drive DO	R/W	N/A	u16

Bit 7 – Relay digital output control

- (1) Enable
- (0) Disable

Bit 6 - Spare digital output

- (1) Enable
- (0) Disable

Bit 5 - Set major fault optocoupler⁽¹⁾

- (1) Module handles the fault relay
- (0) PDI handles the fault relay

Bit 4 - Switch the unit ON/OFF depending on the remote polarity register

- (1) Set the pin driver high
- (0) Set the pin driver low

Bit 3 – Current setpoint in centi

Bit 2 – Voltage setpoint in centi

Bit 1 – Sets the fan speed. Duty cycle from 0 – 100%, equivalent to 0x00 – 0x64_{hex}

Bit 0 - Set rection of LED drive output.

- (10) Software controlled (Normal operation)
- (01) turn on LED
- (00) turn off LED

⁽¹⁾ Normally off

6.1.6 Readouts A (register 6)

Bit address	Sub register Description	Access	Default value	Data type
Bit 7	major fault input	R		u8
Bit 6	power good	R		u8
Bit5	Spare input	R		u8
Bit4	Voltage	R		u16
Bit3	Current	R		u16
Bit2	Power	R		u16
Bit1	Temp	R		s16
Bit0	Temp ext	R		s16

Bit 7 – Check for major fault input status

(1) High

(0) Low

Bit 6 – Check for power good

(1) High

(0) Low

Bit 5 – Spare input

(1) High

(0) Low

Bit 4 – Return output voltage calibrated in centi Volts

Bit 3 – Return output current calibrated in centi Amps

Bit 2 – Return output power calibrated in centi W

Bit 1 – Return °C from the PDI board

Bit 0 – Return external temperature in °C

6.1.7 Readouts B (register 7)

Bit address	Sub register Description	Access	Default value	Data type
Bit7	Fan RPM	R		u16
Bit6	Alarm status	R		u32
Bit (5:0)	Reserved			

Bit 7 – Returns fan rpm by the PDI

Bit 6 – Alarm flags. Return bits (31:0)

- (0) Output voltage below low limit
- (1) Output voltage above high limit
- (2) Output current below low limit
- (3) Output current above high limit
- (4) Internal temperature below low limit
- (5) Internal temperature above high limit
- (6) External temperature below low limit
- (7) External temperature above high limit
- (8) FAN blocket
- (9) Power good alarm
- (10) Spare DI alarm
- (11) Major fault signal
- (12-31) Reserved for future use

Bit (5:0) - Reserved

6.1.8 Calibration A (register 8)

Bit address	Sub register Description	Access	Default value	Data Type
Bit7	Voltage low point	R/W	N/A	u16
Bit6	Voltage low high	R/W	N/A	u16
Bit5	Voltage high high	R/W	N/A	u16
Bit4	Current low	R/W	N/A	u16
Bit3	Current high	R/W	N/A	u16
Bit2	CB sense low	R/W	N/A	u16
Bit1	CB sense high	R/W	N/A	u16
Bit 0	Reserved			

- Bit 7 - Calibrate voltage low point. Send measured output voltage in cV at around 0-10 V on output
- Bit 6 - Calibrate voltage low, high point. Send measured output voltage in cV at around 18-20 V on output
- Bit 5 - Calibrate voltage high, high point. Send measured output voltage in cV at around 60-75 V on output
- Bit 4 - Calibrate current low point. Send measured output current in cA at around 0-1 A on output
- Bit 3 - Calibrate current low point. Send measured output current in cA at around 20-45 mV across the shunt resistor
- Bit 2 - Calibrate CB low point. Send measured output current in cA at around 0-1 A on output
- Bit 1 - Calibrate CB high point. Send measured output current in cA at around 60-100% load on output
- Bit 0 - Reserved

6.1.9 Calibration B (register 9)

Bit address	Sub register Description	Access	Default value	Data Type
Bit7	Voltage ref DAC low point	R/W	N/A	u16
Bit6	Voltage ref DAC high point	R/W	N/A	u16
Bit5	Current ref DAC low point	R/W	N/A	u16
Bit4	Current ref DAC high point	R/W	N/A	u16
Bit (3:0)	Reserved			

Bit 7 - Voltage reference digital-analogue conversion low point

Bit 6 - Voltage reference digital-analogue conversion high point

Bit 5 - Current reference digital-analogue conversion low point

Bit 4 - Current reference Digital-analogue conversion high point

Bit (3:0) – Reserved

6.1.10 Info A (register 10)

Bit address	Sub register Description	Access	Default value	Data Type
Bit7	Serial number	R		u32
Bit6	Revision number	R		u16
Bit5	PN	R		u32
Bit4	SW revision	R		u8 * 5
Bit3	BOOT SW revision	R		u16
Bit2	BOOT SW PN	R		u32

- Bit 7 – PDI Serial number
- Bit 6 – PDI Revision number
- Bit 5 – PDI part number
- Bit 4 – Software revision
- Bit 3 – Boot software revision
- Bit 2 – BOOT software PN
- Bit 1 – Software update
- Bit 0 – Processor reset or hand over to bootloader