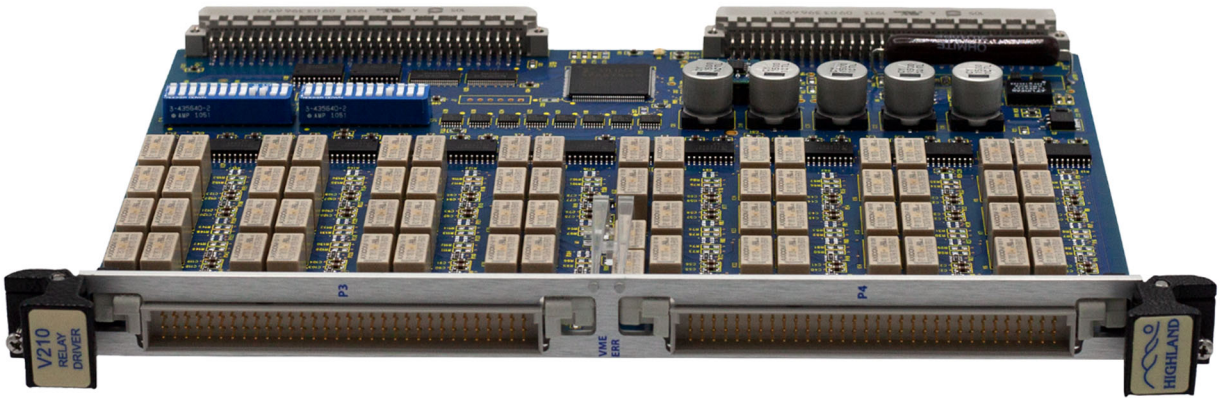
HIGHLAND TECHNOLOGY

V210

VME RELAY MODULE



Technical Manual

October 31, 2022

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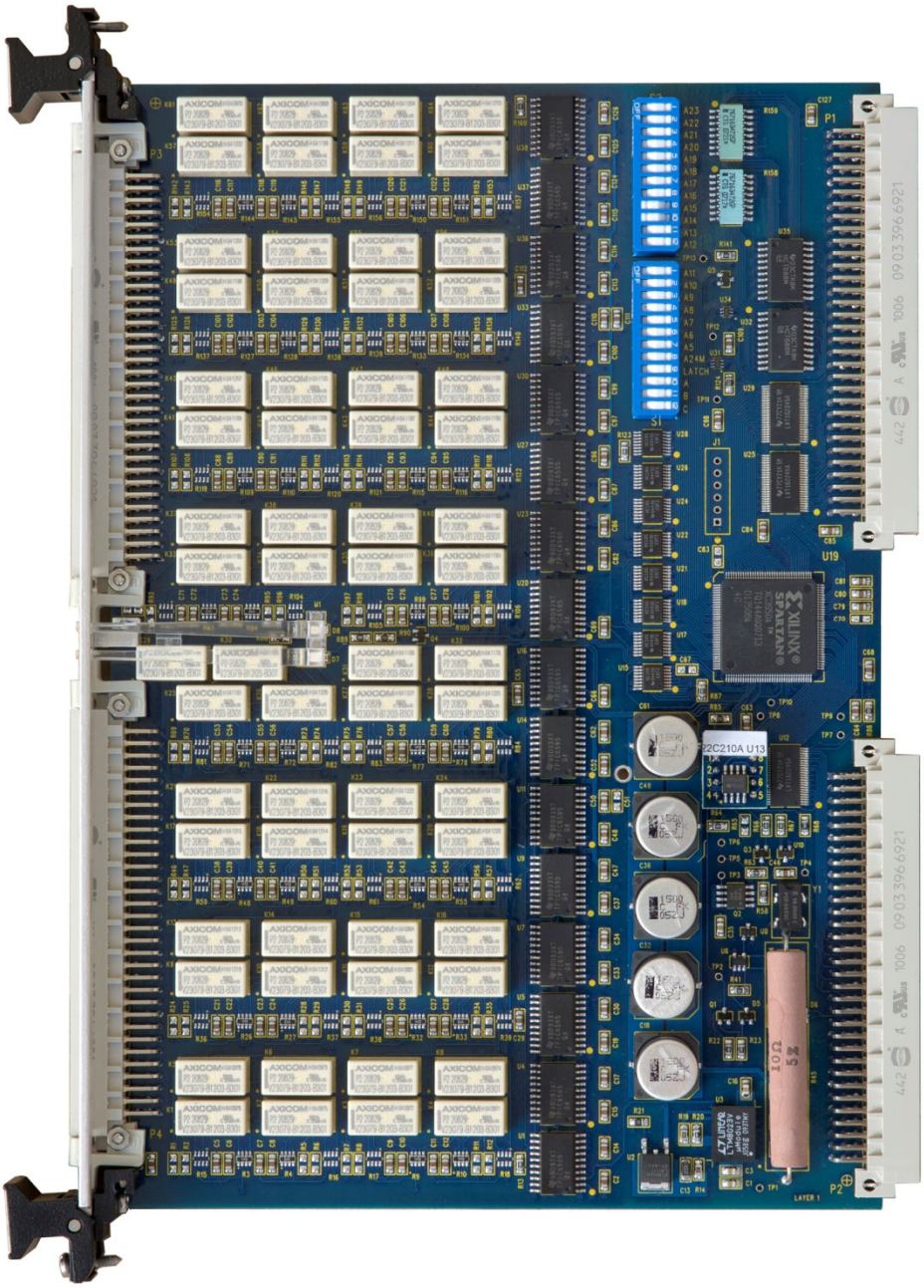
Table of Contents

1 Introduction

The V210 is a single-wide, 6U VME module that provides 64 VME-controlled SPDT relays. It can be user-configured to operate in static or latching modes. All addresses and options are DIP-switch set.

The V210 is an exact hardware and register compatible replacement for all versions of VMIC model VMIVME-2210.



2 Specifications

FUNCTION	64-channel VME relay module
DEVICE TYPE	16-bit VME register-based slave: A24:A16:D16:D32 Implements 32 bytes of VME registers at switch selectable addresses in the VME 16 or 24 bit addressing spaces
CHANNELS	64 relays
OPERATING TEMPERATURE	0 to 60°C; extended MIL/COTS ranges available
LIMITING CONTINUOUS CURRENT AT MAX. AMBIENT TEMPERATURE	1A
MAXIMUM SWITCHING VOLTAGE	220 Vdc 250 Vac
MAXIMUM SWITCHING CAPACITY	60 W
CALIBRATION INTERVAL	One year
POWER	Standard VME supplies: +5 V, 200 mA +12 V, 200 mA -12 V, 200 mA
CONNECTORS	Two 96-pin DIN male, front panel
INDICATORS	LEDs indicate VME access, error flag
PACKAGING	6U single-wide VME module
CONFORMANCE	ANSI/VITA 1-1994 (R2002) VMEbus spec

3 Overview

The V210 is a single-wide, 6U VME module that includes 64 SPDT relays and drivers. User-settable DIP switches set the A16/A24 VME address mode, VME address, and select whether the relays are statically operated or operate in latching mode.

Users can read back actual relay contact states. The V210 is fully compatible with all versions of the VMIVME-2210.

3.1 Front-Panel LEDs

There are two front-panel LEDs. The blue LED will flash on any VME access. The red LED will illuminate when there is a logic “zero” on bit 15 of the Control and Status Register (CSR). The control and status register will powerup zeroed, the red LED will be illuminated until it is cleared by a logic “1’ on bit 15 of the CSR. See Section 5.3 for more information about the CSR register.

3.2 Operating Modes

A DIP-switch configures the relays to operate in static or latching mode.

Static Mode

In static mode, relays de-energize on power failure and when bit 14 and/or bit 13 of the Control and Status Register (CSR) are disabled.

Latching Mode

In latched mode, relays retain their position through power failure. When the system is powered back up, bit 14 and 13 of the Control and Status Register (CSR), and all the relay control registers (CTL*) will be set to logic “zero”. To keep the latched configuration, the user must set all the control registers (CTL*) to the latched state of the relays which can be read on the Relay Contact Registers (RCON*), before bit 14 and 13 of the Control and Status Registers (CSR) are set to logic level ‘1’.

4 Connectors and Installation

4.1 Address DIP Switches

The V210 occupies 16 16-bit registers in the VME A16 or A24 address spaces.

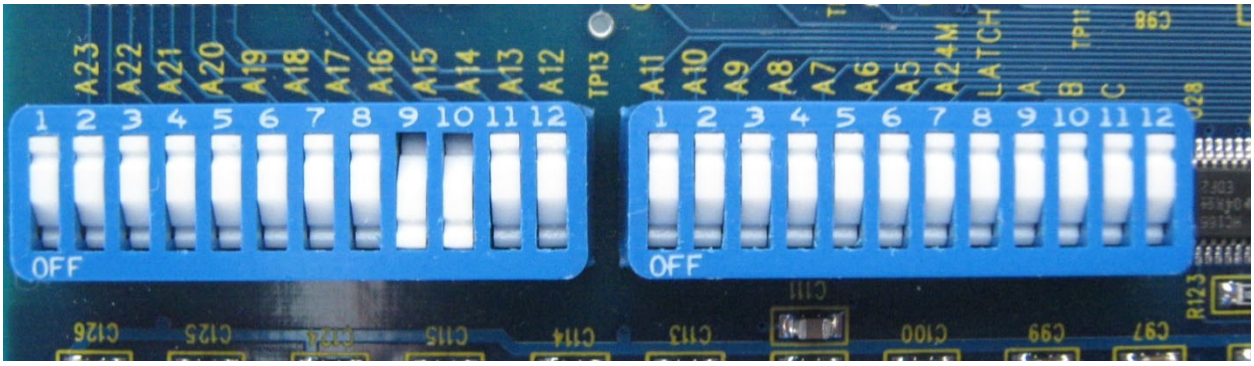
Two 12-position rocker-type dipswitches are provided near the top edge of the board to set the module base address. They are labeled, left to right, "A23" through "A5", and "A24M". S1 positions 9 to 12 are not used for addressing the V210.

To set a switch to the logical "1" or "ON" position, press the side of the switch nearest its "Axx" yellow lettering. Use a toothpick or paper clip, not a pen or pencil.

The A24M switch, when set, allows the board to operate in the VME 24-bit (A24) address space; in this case, all address switches are active and the board responds to VME address modifier codes 0x39 and 0x3D.

If the A24M switch is off, the module resides in the A16 space and responds to address modifiers 0x29 and 0x2D. In this case, only address switches A15 through A5 are active.

Units are shipped with switches A15 and A14 on, all others off, locating the register base at 0xC000 in the A16 space, as shown in the picture below.



4.2 Operating Mode Switch

The V210 is user-selectable to operate in static or latching mode. To set the V210 to operate in latching mode, set the LATCH switch to the logical “1” or “ON” position. The LATCH switch is located on S1 position 9 and is labeled LATCH.

Units are shipped for the V210 to operate in static mode, as shown in the photo above.

4.3 Installation

The V210 may be installed in any VME(IEEE 1014) crate, including VME64 variants. It supports 32-bit data transfers using the P1 and P2 connectors, or may be used in 16-bit or 8-bit mode using only the P1 backplane connector.

The V210 passes all interrupt and bus grant signals, so it may be used with backplane grant jumpers installed or not installed.

⚠ **CAUTION: Do not install or remove the V210 with crate power on. VME modules are not hot-pluggable. The V210 will be damaged if hot-plugged.**

⚠ **CAUTION: Fully seat the module and secure front-panel screws before applying power.**

⚠ **CAUTION: Handle the V210 with proper ESD precautions to avoid static damage.**

4.4 96-pin DIN Connectors

Two 96-pin DIN connectors are provided on the front panel. Each relay uses one row of pins. The A column connects to the normally open (NO) contact, the B column connects to the normally closed (NC) contact, and the C column connects to the common contact (COM). This way a 64-conductor cable can be used to switch 1 Form A (SPST) contacts. These are the normally open contacts.

The pinout of the 96-pin DIN connectors is as follows:

P3 Pin	Function	P4 Pin	Function
A32	Channel 63 – NO	A32	Channel 31 – NO

P3 Pin	Function	P4 Pin	Function
B32	Channel 63 – NC	B32	Channel 31 – NC
C32	Channel 63 – COM	C32	Channel 31 – COM
A31	Channel 62 – NO	A31	Channel 30 – NO
B31	Channel 62 – NC	B31	Channel 30 – NC
C31	Channel 62 – COM	C31	Channel 30 – COM
A30	Channel 61 – NO	A30	Channel 29 – NO
B30	Channel 61 – NC	B30	Channel 29 – NC
C30	Channel 61 – COM	C30	Channel 29 – COM
A29	Channel 60 – NO	A29	Channel 28 – NO
B29	Channel 60 – NC	B29	Channel 28 – NC
C29	Channel 60 – COM	C29	Channel 28 – COM
A28	Channel 59 – NO	A28	Channel 27 – NO
B28	Channel 59 – NC	B28	Channel 27 – NC
C28	Channel 59 – COM	C28	Channel 27 – COM
A27	Channel 58 – NO	A27	Channel 26 – NO
B27	Channel 58 – NC	B27	Channel 26 – NC
C27	Channel 58 – COM	C27	Channel 26 – COM
A26	Channel 57 – NO	A26	Channel 25 – NO
B26	Channel 57 – NC	B26	Channel 25 – NC
C26	Channel 57 – COM	C26	Channel 25 – COM
A25	Channel 56 – NO	A25	Channel 24 – NO
B25	Channel 56 – NC	B25	Channel 24 – NC
C25	Channel 56 – COM	C25	Channel 24 – COM
A24	Channel 55 – NO	A24	Channel 23 – NO

P3 Pin	Function	P4 Pin	Function
B24	Channel 55 – NC	B24	Channel 23 – NC
C24	Channel 55 – COM	C24	Channel 23 – COM
A23	Channel 54 – NO	A23	Channel 22 – NO
B23	Channel 54 – NC	B23	Channel 22 – NC
C23	Channel 54 – COM	C23	Channel 22 – COM
A22	Channel 53 – NO	A22	Channel 21 – NO
B22	Channel 53 – NC	B22	Channel 21 – NC
C22	Channel 53 – COM	C22	Channel 21 – COM
A21	Channel 52 – NO	A21	Channel 20 – NO
B21	Channel 52 – NC	B21	Channel 20 – NC
C21	Channel 52 – COM	C21	Channel 20 – COM
A20	Channel 51 – NO	A20	Channel 19 – NO
B20	Channel 51 – NC	B20	Channel 19 – NC
C20	Channel 51 – COM	C20	Channel 19 – COM
A19	Channel 50 – NO	A19	Channel 18 – NO
B19	Channel 50 – NC	B19	Channel 18 – NC
C19	Channel 50 – COM	C19	Channel 18 – COM
A18	Channel 49 – NO	A18	Channel 17 – NO
B18	Channel 49 – NC	B18	Channel 17 – NC
C18	Channel 49 – COM	C18	Channel 17 – COM
A17	Channel 48 – NO	A17	Channel 16 – NO
B17	Channel 48 – NC	B17	Channel 16 – NC
C17	Channel 48 – COM	C17	Channel 16 – COM
A16	Channel 47 – NO	A16	Channel 15 – NO

P3 Pin	Function	P4 Pin	Function
B16	Channel 47 – NC	B16	Channel 15 – NC
C16	Channel 47 – COM	C16	Channel 15 – COM
A15	Channel 46 – NO	A15	Channel 14 – NO
B15	Channel 46 – NC	B15	Channel 14 – NC
C15	Channel 46 – COM	C15	Channel 14 – COM
A14	Channel 45 – NO	A14	Channel 13 – NO
B14	Channel 45 – NC	B14	Channel 13 – NC
C14	Channel 45 – COM	C14	Channel 13 – COM
A13	Channel 44 – NO	A13	Channel 12 – NO
B13	Channel 44 – NC	B13	Channel 12 – NC
C13	Channel 44 – COM	C13	Channel 12 – COM
A12	Channel 43 – NO	A12	Channel 11 – NO
B12	Channel 43 – NC	B12	Channel 11 – NC
C12	Channel 43 – COM	C12	Channel 11 – COM
A11	Channel 42 – NO	A11	Channel 10 – NO
B11	Channel 42 – NC	B11	Channel 10 – NC
C11	Channel 42 – COM	C11	Channel 10 – COM
A10	Channel 41 – NO	A10	Channel 9 – NO
B10	Channel 41 – NC	B10	Channel 9 – NC
C10	Channel 41 – COM	C10	Channel 9 – COM
A09	Channel 40 – NO	A09	Channel 8 – NO
B09	Channel 40 – NC	B09	Channel 8 – NC
C09	Channel 40 – COM	C09	Channel 8 – COM
A08	Channel 39 – NO	A08	Channel 7 – NO

P3 Pin	Function	P4 Pin	Function
B08	Channel 39 – NC	B08	Channel 7 – NC
C08	Channel 39 – COM	C08	Channel 7 – COM
A07	Channel 38 – NO	A07	Channel 6 – NO
B07	Channel 38 – NC	B07	Channel 6 – NC
C07	Channel 38 – COM	C07	Channel 6 – COM
A06	Channel 37 – NO	A06	Channel 5 – NO
B06	Channel 37 – NC	B06	Channel 5 – NC
C06	Channel 37 – COM	C06	Channel 5 – COM
A05	Channel 36 – NO	A05	Channel 4 – NO
B05	Channel 36 – NC	B05	Channel 4 – NC
C05	Channel 36 – COM	C05	Channel 4 – COM
A04	Channel 35 – NO	A04	Channel 3 – NO
B04	Channel 35 – NC	B04	Channel 3 – NC
C04	Channel 35 – COM	C04	Channel 3 – COM
A03	Channel 34 – NO	A03	Channel 2 – NO
B03	Channel 34 – NC	B03	Channel 2 – NC
C03	Channel 34 – COM	C03	Channel 2 – COM
A02	Channel 33 – NO	A02	Channel 1 – NO
B02	Channel 33 – NC	B02	Channel 1 – NC
C02	Channel 33 – COM	C02	Channel 1 – COM
A01	Channel 32 – NO	A01	Channel 0 – NO
B01	Channel 32 – NC	B01	Channel 0 – NC
C01	Channel 32 – COM	C01	Channel 0 – COM

5 VME Registers

The V210 implements 16 16-bit VME registers. REG# below is the ordinal register number in decimal; OFFSET is the hex VMEbus offset from the module base address.

Registers identified as "RO" should be treated as read-only and should not be written from VME; these registers are periodically refreshed by the V210.

Read-write (RW) registers are written by VME and are not altered internally by the V210.

Registers are fully compatible to the VMIC model VMIVME-2210. Registers numbers 2, 3, and 4 are used by Highland for model and version information. These registers are reserved, but they are not used on VMIC units.

5.1 VME Register Map

REG Name	REG#	Offset	R/W	Function
BDID	0	0x00	RO	Board ID: reads 6912 (0x1B00)
CSR	1	0x02	RW	Controls the relay drivers and front panel LED
VXI MFR	2	0x04	RO	VXI mfr ID: reads 65262 (0xFEEE)
VXITYPE	3	0x06	RO	module type, always 22210 decimal
FPGA REV	4	0x08	RO	Firmware revision
CTL0	8	0x10	RW	Controls relay channels 63 to 48
CTL1	9	0x12	RW	Controls relay channels 47 to 32
CTL2	10	0x14	RW	Controls relay channels 31 to 16
CTL3	11	0x16	RW	Controls relay channels 15 to 0
RCON0	12	0x18	RO	Reads the contacts of the relay channels 63 to 48
RCON1	13	0x1A	RO	Reads the contacts of the relay channels 47 to 32
RCON2	14	0x1C	RO	Reads the contacts of the relay channels 31 to 16
RCON3	15	0x1E	RO	Reads the contacts of the relay channels 15 to 0

5.2 Module Overhead Registers

A number of read-only overhead registers are provided.

BDID: always reads 0x1B00, VMIC id (to maintain register compatibility).

VXI MFR: always reads 0xFEEE, Highland's registered VXI ID code.

VXITYPE: always reads 22210 decimal.

FPGA REV: ASCII code identifying the revision letter of the firmware, typically 0x0041, ascii "A"

5.3 CSR - Control and Status Register

The CSR is used to control the relay drivers and a front panel LED. This register has three active bits (15 to 13). The rest of the bits are not used, they are read back as written.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ERR	P4TM	P3TM													

ERR - Bit 15 controls the front panel ERR LED. When a logic “zero” is written to this bit, the LED will illuminate. This bit is cleared when power is applied or after a system reset. However, it is under program control and can be used to locate faulty boards in a system.

The relays are controlled by registers which data is stored in. The outputs of these registers go to the drivers, which then activate the relays. These drivers can be disabled by the CSR. Writing a logic “zero” to either bit 14 or bit 13 will disable the drivers associated with the listed output channels.

P4TM - Bit 14 controls the relays going to connector P4 (Channels 0 through 31).

P3TM - Bit 13 controls the relays going to connector P3 (Channels 32 through 63).

If the V210 is set to latching relay mode, data written to the registers will not change the state of these relays. If the V210 is set to static relay mode, they will go to their normal contact positions (normally open contacts will open and normally closed contacts will close).

Similar to bit 15, these bits will be cleared when power is applied or after a system reset. This is to prevent random data from disturbing the field circuitry controlled by these relays.

5.4 CTL - Relay Control Registers*

These registers control the relay drivers and hence the relays. Each bit controls one relay. The relay or output channel for each bit is listed in the following tables. Writing a logic "one" to this bit will activate the “set” relay coil. This will force the normally closed contact to open and the normally open contact to close. The relay will close its normally closed contact and open the normally open contact whenever a logic "zero" is written to its control bit.

CTL0 – Control Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH63	CH62	CH61	CH60	CH59	CH58	CH57	CH56	CH55	CH54	CH53	CH52	CH51	CH50	CH49	CH48

CTL1 – Control Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH47	CH46	CH45	CH44	CH43	CH42	CH41	CH40	CH39	CH38	CH37	CH36	CH35	CH34	CH33	CH32

CTL2 – Control Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH31	CH30	CH29	CH28	CH27	CH26	CH25	CH24	CH23	CH22	CH21	CH20	CH19	CH18	CH17	CH16

CTL3 – Control Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH15	CH14	CH13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

5.5 RCON- Relay Contact Registers*

These registers report the state of a second set of contacts in the relays. The contacts reflect the condition of the contacts, which may take as much as 5.5 msec to finally switch after a change command is sent to its Control Register. The logic level reads from this register bit will match the level in the Control Register’s bit after the contact has had enough time to settle into its new position. If a logic "one" is written to Control Register 5, bit 19, channel 19 will switch to its active state. Normally open contacts will

close, 7 msec later reading Contact Register 5, bit 19 will show a logic "one", just like its counterpart in the Control Register.

RCON0 – Relay Contact Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH63	CH62	CH61	CH60	CH59	CH58	CH57	CH56	CH55	CH54	CH53	CH52	CH51	CH50	CH49	CH48

RCON1 – Relay Contact Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH47	CH46	CH45	CH44	CH43	CH42	CH41	CH40	CH39	CH38	CH37	CH36	CH35	CH34	CH33	CH32

RCON2 – Relay Contact Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH31	CH30	CH29	CH28	CH27	CH26	CH25	CH24	CH23	CH22	CH21	CH20	CH19	CH18	CH17	CH16

RCON3 – Relay Contact Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH15	CH14	CH13	CH12	CH11	CH10	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

6 Versions

V210-1: 64-channel VME-2210 compatible relay module with cable latches

V210-11: 64-channel VME-2210 compatible relay module with cable latches and conformal coating

7 Hardware and Firmware Revision History

7.1 Hardware Revision History

Revision D July 2019
Improves manufacturability

Revision C April 2012
Improves manufacturability

Revision B November 2011
Improves manufacturability

Revision A April 2011
Initial PCB release

7.2 Firmware Revision History

22C210-A April 2015
Initial V210 release