CONTROLLER-02

User and integration manual
4 x 20 character LCD with I2C, encoder and RC5 interfaces
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1. Module overview

CONTROLLER-02 provides the display and user-input interface for a DIY audio system. An external main controller writes text and LCD commands over I2C and reads control events. The connected system decides what rotation, selection and power events actually do.

Typical applications include source selection, settings, volume indication and status screens. These menus and audio functions are implemented by the main controller. The module itself does not control audio signals or switch the system power supply.

Component	Function
LCD	Four lines of 20 characters; blue backlight with white characters.
Encoder	Rotation direction and push-button input produce separate control events.
IR	Recognises configured RC5 address/command combinations for down, up, select and power.
I2C	Write text and display commands; read events from the queue.
Backlight	10-bit PWM, adjustable brightness and gradual fade-in/fade-out.

Delivery and accessories

According to the product page: assembled and tested module, gold-plated headers and dimensions of 113 x 61 mm. ENCODER-A, ENCODER-B, IRECV-01A, IRECV-01B and Molex cables are sold separately.

2. Connections and first use

The four-pole connection carries power and I2C data. Connect the main controller and module to a common ground and the correct SDA/SCL connections. Before applying power, verify connector pin order, supply voltage, polarity and logic levels against the schematic for your board revision. These electrical details cannot be established completely from the firmware and are not specified as wiring instructions in this manual.

Connect a suitable encoder and, if required, a compatible IR receiver. Make or change connections with the power switched off. Use the schematic image provided on the product page as the reference for physical connections.

Getting started

1. Check board revision, power, ground and connector orientation against the schematic.

2. The module's 7-bit I2C address is 0x3E (62 decimal).

3. Send display-on command 0xFF. This clears the display and gradually increases the backlight.

4. Set the LCD position and write a short test message. Check each display line.

5. Poll control events over I2C and test rotation, push-button input and optional RC5 operation.

3. Operation and event codes

Event	Default value (decimal)
Encoder down / RC5 down	10
Encoder up / RC5 up	20
Encoder push / RC5 select	30
RC5 power	40
Button 1 / PD.0	50
Button 2 / PD.1	60
No event available	0

The queue holds 64 bytes. Each master read requests an event byte; an empty queue returns 0. Read regularly to prevent events accumulating. Do not use 0 as a custom event code, since it indicates an empty queue.

Default RC5 settings use address 1, with down=1, up=2, select=3 and power=63. The updated Worker ignores unrecognised combinations. Encoder events are processed only when the terminal is on; Worker does not apply this terminal-status check to IR events.

4. I2C commands

First byte	Following bytes	Operation
0xFF	None	Clear and switch on the display; fade in the backlight. Clear queued events and rotation flags.
0xFE	None	Clear and switch off the display; fade out the backlight.
0xFD	High, low, on/off	Receive brightness value. A final byte of 1 applies that level; any other value sets illumination to 0.
0xFC	14 configuration bytes	Set response codes and RC5 addresses/commands in the order below.
0x40	Text bytes	Write subsequent bytes as LCD characters.
Other prefix	LCD command bytes	Write subsequent bytes as LCD control commands. Avoid the reserved prefixes above.

Send the prefix and its associated data together in one I2C write transaction. A new write transaction resets the firmware byte counter. Fade-in and fade-out use approximately 1 ms per brightness step: 1023 steps take about one second, excluding overhead.

Configuration order after 0xFC

Byte position	Setting
1-4	Rot_push, Rot_up, Rot_down, Rot_power
5-6	Button1 (PD.0), Button2 (PD.1): configurable event codes
7-8	Ir_up_address, Ir_up_command
9-10	Ir_down_address, Ir_down_command
11-12	Ir_select_address, Ir_select_command
13-14	Ir_power_address, Ir_power_command

Settings are held in RAM. No EEPROM storage for these settings was found in this source. The main controller should resend the desired configuration after a restart.

Brightness is limited to 100-1023, approximately 10-100% of the PWM scale. The third byte of 0xFD controls illumination only and does not change the complete terminal status. Use 0xFF or 0xFE for full display on/off control.

5. Additional buttons

Connect a normally open momentary button between PD.0 and GND, and another between PD.1 and GND. Internal pull-up resistors keep each input high when released; pressing a button makes it low. Check the physical connector or pad positions against the board schematic.

Button 1 produces event code 50 by default; Button 2 produces 60. Each press produces one event, with 35 ms debounce. Release the button before pressing again; holding it does not generate automatic repeat. Both buttons are processed only while the terminal is on (Term_on_off = 1). The main controller assigns the action to each event.

The event codes can be changed through configuration command 0xFC: data byte 5 is Button1 and data byte 6 is Button2. These settings are volatile and must be reapplied after a restart.

6. Troubleshooting

Symptom	Check
No display text	Power, contrast adjustment if present, I2C address, terminal-on command and text prefix.
No encoder events	Encoder and push-button wiring, terminal status and regular master reads.
No button events	PD.0/PD.1 connections to GND, terminal switched on, configured codes and regular master reads.
No IR response	RC5 protocol, receiver, configured address/command and Timer1 configuration.
Settings lost	Settings are volatile; resend them after power-up.

References: supplied AP-CONTROLLER-02.bas; product page and schematic at https://audio-products.eu/shop/controller-02/. Enquiries: info@audio-products.eu. Technical support: techsupport@audio-products.eu.