

OPERATION MANUAL

TIMING SYSTEM FLEXITIMER

MX486



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1. Warnings and Precautions for Use

1.1. Safety Warnings:

- **Avoid exposure to moisture** : The Flexitimer MX486 is an electronic device. Make sure it is installed in a dry and clean environment to avoid any damage from water or moisture.
- **Never use the product with voltages higher than those specified** : A 12V DC power supply is required. Incorrect voltage may damage the product or cause electric shock hazards.
- **Handle components with care** : Avoid touching circuit boards and electronic components with wet or electrostatically charged hands. Wear an ESD wrist strap when assembling to prevent electrostatic discharge.
- **Do not modify the circuitry** : Any unauthorized modification of the components or circuitry of the Flexitimer MX486 may result in system failure and void the warranty.

1.2. Precautions for use:

- **Check the connections** before powering the system: Make sure all wiring is properly connected according to the instructions in the manual.
- **Turn off the appliance before performing any service** : For any modifications or maintenance, make sure the system is turned off and unplugged.
- **Do not leave within reach of children** : This product contains small electronic parts that may pose a hazard if swallowed or mishandled.

1.3. Recycling Instructions:

- **Do not dispose of this product with household waste** : In accordance with the European WEEE (Waste Electrical and Electronic Equipment) Directive, this product must be recycled in approved recycling centers for electronic equipment.
- **Recycling of electronic components** : At the end of the life of the Flexitimer MX486, drop it off at a specialized collection point so that its electronic components, including metals and plastics, can be recovered and recycled in compliance with environmental standards.
- **Eco-friendliness** : By recycling this product correctly, you are helping to protect the environment and reduce e-waste.

2. Introduction

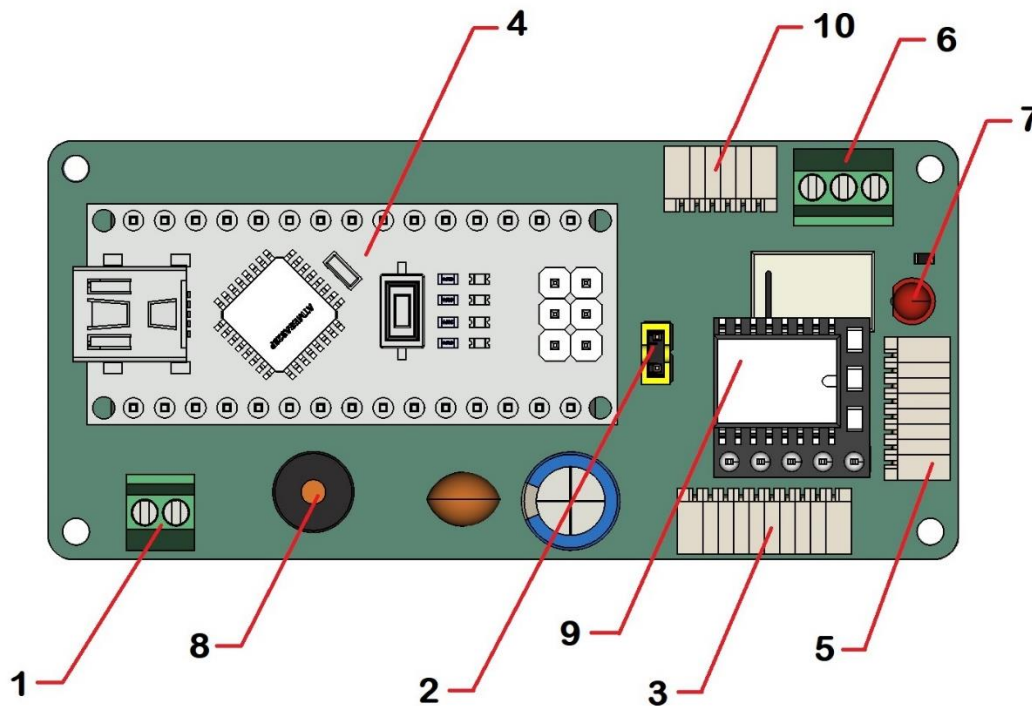
The Flexitimer MX486 is a versatile timing system designed by Foxtek Technology Systems, based on the Arduino Nano platform. It is a modular system consisting of a control board and a display unit, which can be used for various timing applications such as clocks, countdown timers, stopwatches as well as other functions that can be programmed into the source codes. The system is highly flexible and supports additional modules like RTC for enhanced functionality. This manual provides a detailed description of the entire system, including the control board, display unit, and associated connectors and components.

3. System Overview

The Flexitimer MX486 consists of the following main components:

- **Control board** : The central processing unit that manages the timing logic, inputs, and outputs.
- **Display Unit** : The visual output module displaying the time and status indicators.
- **I/O Expansion Board** : DF13-to-terminal block extensions for power, communication, and I/O operations.
- **Numeric Keypad Module** : 4x4 matrix numeric keypad to DF13 for quick programming and control of the device.
- **DF13 Link** : DF13-to-DF13 6 and 10-wire link cables to connect the DF13-to-terminal block conversion expansion board and the display to the control board.

4. Control Board Components

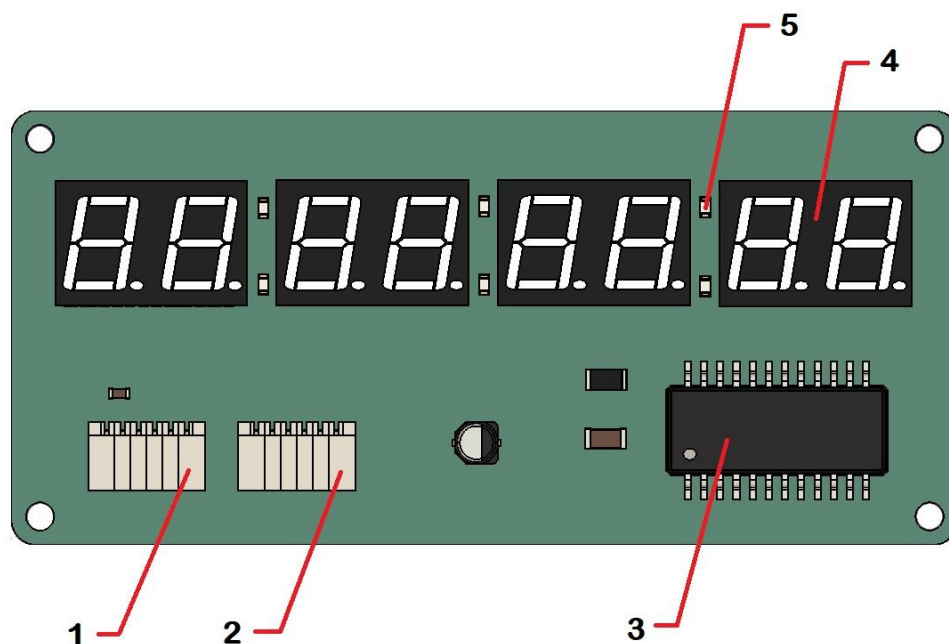


The control board is the main module that controls the entire system. The following is a detailed description of each component corresponding to the numbers shown in the diagram provided:

1. **12V DC Power Input** : This terminal block is used to connect the 12V DC power supply. It powers the entire control board, including the Arduino Nano and all connected peripherals.
2. **5V Power Selector (Jumper)**: This jumper allows you to choose the 5V power source for the display unit and the I/O connector:
 - **Jumper present** : Connects the 5V regulator integrated into the entire timer and can operate in 12V and or by USB through the regulated power supply of the Arduino.
 - **Jumper removed** : The device can be powered by USB only by inhibiting the power supply to the 5V timer regulator.
3. **DF13 10-pin I/O connector** : This connector provides a variety of analog outputs, including:
 - **A4 to A7** : General purpose analog outputs, with A4 (SDA) and A5 (SCL) also serving as the I2C bus.
 - **GND, 5V and 3.3V** : Power outputs for connected devices.
 - **TX0, RX1**: Serial data transmission and reception.

4. **Arduino Nano Microcontroller** : The main processing unit that runs the timing programs. It interacts with all other components on the board, including the relay, buzzer, and display.
5. **DF13 8-pin keypad connector** : This connector allows the connection of a 4x4 numeric keypad, used to enter timing data and control the system.
6. **Terminal block for relay NO/NC contacts** : This terminal block provides access to the relay's Normally Open (NO) and Normally Closed (NC) contacts, allowing external circuits to be controlled according to the timing schedule.
7. **Relay Status LED** : This LED indicates whether the relay is active (LED on) or inactive (LED off).
8. **Buzzer** : A sound component that provides audible alerts or notifications based on the status of the system.
9. **Optional DS3231 PSTN Module Slot** : This slot allows for the addition of a Real-Time Clock (RTC) module, enabling time-based functions even when the system is powered off.
10. **DF13 6-pin output terminal block for display unit** : This output connects the control board to the display unit, providing both power and data signals for 7-segment digits and status LEDs.

5. Display Unit Components



The display unit provides a visual interface for the MX486 Flexitimer, displaying the current time, countdown progress or stopwatch readings. The components of the display unit are as follows:

1. **DF13 6-pin input** : This connector is the input connection for the display unit, receiving signals for the MAX7219 controller, the 7-segment digit power supply and the LED power supply. The pins are:
 - **DIN, CLK, CS** : Data lines for the MAX7219.
 - **+LED** : Input of the alert LEDs.
 - **5V** : Power supply for display.
 - **GND** : Ground connection.
2. **DF13 6-pin output** : This connector is used to daisy-chain additional display units if required. It reflects signals from the input connector to connect another display unit.
3. **MAX7219 Integrated Circuit** : The main integrated circuit for the 7-segment display. It controls the illumination of the segments, simplifying wiring and control logic.
4. **8-digit 7-segment display** : The main display component, consisting of four 7-segment double digits, which can display numbers or characters according to the timing function.
5. **Alert LEDs** : Six status LEDs provide visual indicators of different system states, such as alarms or active modes.

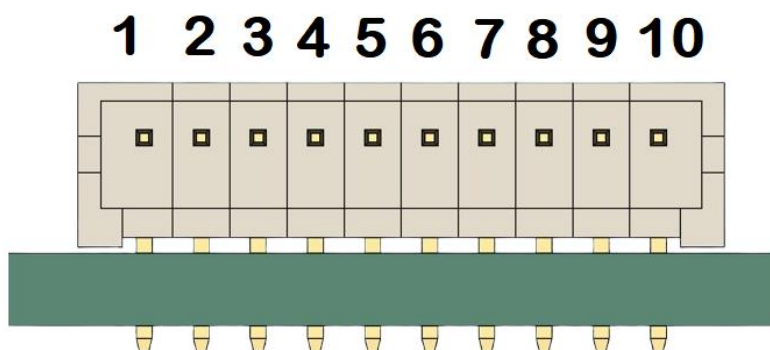
6. Pinout configuration

This section describes in detail the pinouts of the various connectors used in the system, such as DF13 connectors, IDC connectors, and power terminal blocks. A good understanding and accurate installation of these connections is necessary to ensure optimal performance and stability of the entire system.

In the following sections, you will find specific information about pin assignments for each connector, as well as instructions on how to properly connect each device.

6.1. Configuring the DF13 I/O Connector pinouts

The Flexitimer FX486 is equipped with a 10-pin DF13 type I/O input/output (I/O) IDC connector, allowing the integration of various modules and external components. This connector supports analog communications, I2C bus, serial communication, as well as power outputs. This provides great flexibility to extend the functionality of the system by adding sensors, peripherals or other electronic devices.

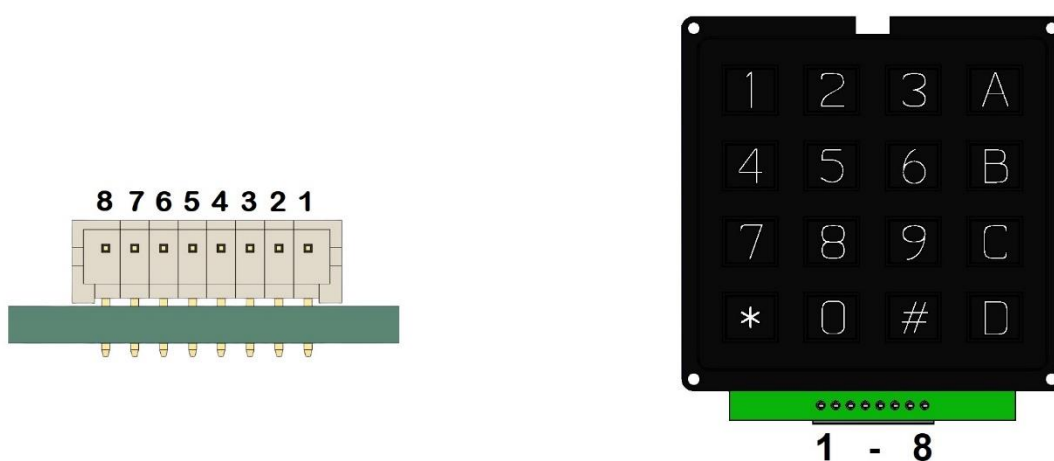


10-pin I/O DF13 Connector Pinout

Brooch	Wording	Description
1	+3.3V	3.3V power output
2	+5V	5V power output
3	RST	Reset Input
4	A7	General analog input/output
5	A6	General analog input/output
6	A5 (SCL)	Analog input/output, I2C clock (SCL)
7	A4 (SDA)	Analog input/output, I2C data (SDA)
8	RX0	Receiving serial data
9	TX1	Serial data transmission
10	GND	General Mass

6.2. Configuring Keypad DF13 Connector Pinouts

The control board of the Flexitimer MX486 includes an 8-pin DF13 connector dedicated to interfacing with a 4x4 numeric keypad. This keypad can be used to enter timing data, start/stop timers, reset the system, and other functions. Below is the pin configuration for the keyboard and its corresponding connections on the 8-pin KPD DF13 connector, which are directly connected to the digital input/output pins of the Arduino Nano.

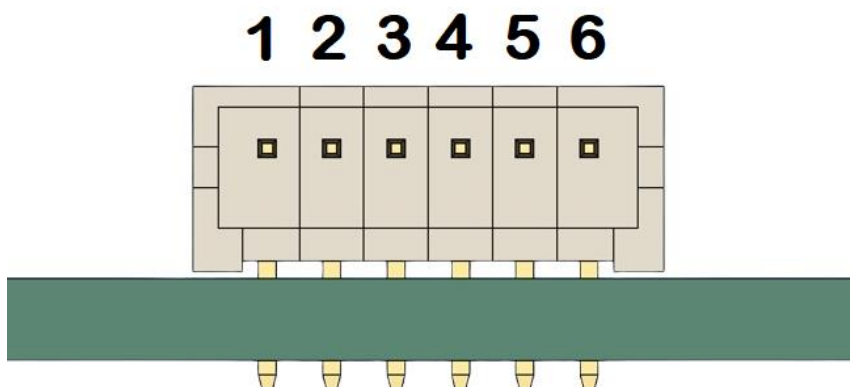


8-pin DF13 KPD connector pinout

Brooch	Wording	Description
1	D2	Arduino Nano Digital I/O Pin 2
2	D3	Arduino Nano Digital I/O Pin 3
3	D4	Arduino Nano Digital I/O Pin 4
4	D5	Arduino Nano Digital I/O Pin 5
5	D6	Arduino Nano Digital I/O Pin 6
6	D7	Arduino Nano Digital I/O Pin 7
7	D8	Arduino Nano Digital I/O Pin 8
8	D9	Arduino Nano Digital I/O Pin 9

6.3. Configuring the DF13 Connector Pinouts of the Display

The DF13 DISP output connector located on the control board allows the control board to be connected to the display unit. Here is the mapping between the DF13 pins on the control board and the display unit.



DF13 6-pin control board DISP output connector:

Brooch	Wording	Description
1	D12	Clock (CLK) for Display Unit
2	D11	LOAD signal (/CS) for display unit
3	D10	Data (DATA) for Display Unit
4	D13	Power supply for the 6 warning LEDs
5	+5V	5V power supply for display unit
6	GND	Mass for Display Unit

DF13 6-pin Display Unit Input Connector:

Brooch	Wording	Mapping on the control chart
1	CLK	D12 - Clock for display management
2	LOAD (/CS)	D11 - Load Control Signal
3	DATA IN	D10 - Data Signal for Display
4	+LED	D13 - Powering Warning LEDs
5	+5V	+5V power supply for display
6	GND	Mass for display

DF13 6-pin Display Unit Output Connector:

Brooch	Wording	Mapping on the control chart
1	CLK	D12 - Clock for display management
2	LOAD (/CS)	D11 - Load Control Signal
3	DATA OUT	D10 - Data Signal for Display
4	+LED	D13 - Powering Warning LEDs
5	+5V	+5V power supply for display
6	GND	Mass for display

By using these DF13 connectors, you ensure that the display receives both the data signals and the power supply needed to correctly display the information and activate the warning LEDs.

7. Assembly Instruction

7.1. Connecting the Display Unit

1. **Connect** the display unit to the control board using the DF13 to DF13 6-pin cable from the display input connector (IN) to the display output connector (DISP) on the control board.
2. If additional display units are required, daisy-chain them using the display's 6-pin output connector (OUT).

7.2. Inserting the Arduino Nano into the control board

1. **Gently insert the Arduino Nano** into the female sockets of the control board by pressing gently but firmly.
2. **Timer Compatibility** : The Flexitimer MX486 is **compatible with** the standard Arduino Nano and Arduino Nano Everyday models only. Other versions of the Arduino Nano, such as the Nano 33, are not functional with this specific configuration due to hardware differences. However, the base Arduino Nano clones are also **adaptable** and will work fine in this setup.

7.3. Numeric keypad and add-ons

1. **Connect** the numeric keypad to the DF13 8-pin (KPD) connector on the control board.
2. If you are using a PSTN module, insert it into the slot provided for the DS3231 PSTN module.

7.4 Connecting the Power Supply

1. **Connect** a 12V DC power supply to the 12V DC power input or plug in the timer via USB via the Arduino NANO.
2. Make sure the 5V power selector jumper is in place if you want to power the timer with 12V.

8. Mechanical assembly

8.1. Components required for assembly:

- 4 x 25 mm M2 spacers
- 4 x 10 mm M2 spacers
- 4 self-locking M2 nuts

8.2. Assembly steps:

1. Preparation of the control chart:

- Take the **25mm spacers**. Attach them to the four corners of the control board using **the self-locking M2 nuts**. These 25mm spacers will serve as a support for the display unit.
- Tighten the nuts firmly so that the board is stable, but not forced, to avoid damaging the circuitry or the PCB.

2. Attaching the Display Unit:

- Place the display unit on top of the 25mm spacers, aligning the mounting holes with the spacers.
- Use the **10mm spacers** to attach the display unit over the control board. Screw them into the 25mm spacers already in place.

3. Final assembly:

- After positioning the display unit and control board with the spacers, check that all parts are securely held.
- Make sure that the components are securely fastened, without excessive backlash, and that there is enough space between the control board and the display unit to avoid direct contact between the circuits.

9. How the system works

Once all components are connected, the MX486 Flexitimer can be programmed and used with the Arduino IDE. Pre-written codes for the clock, countdown timer and stopwatch functions can be downloaded to the Arduino Nano.

9.1. Programming the Arduino Nano

1. **Connect** the Arduino Nano to your computer via USB.
2. **Open** the Arduino IDE and select the correct board and COM port.
3. **Load** the desired timing schedule from Foxtek's GitHub repository. (<https://github.com/FoxtekTS/FLEXITIMER>)
4. **Compile** and **upload** the code to the Arduino Nano.

9.2. Using the Numeric Keypad

- The Flexitimer MX486's 4x4 numeric keypad is a central element for interacting with the system. It allows the user to enter timing data, control timers, and manage various system functions such as starting, stopping, resetting, or configuring specific parameters. This keyboard is connected to the control board via an **8-pin DF13 connector**, which communicates directly with the digital input/output pins of the Arduino Nano.
- Users can reprogram the keys on the numeric keypad to perform specific functions as needed. Thanks to the flexibility of the Arduino Nano platform, it is possible to modify the source code to assign different actions to each key, depending on the application or project at hand.

9.3. Display Monitoring

- The display unit will display the current time, countdown progress, or stopwatch readings. Status LEDs will indicate system statuses, such as alarms or active modes.

10. Maintenance and troubleshooting

10.1. Feeding problems

- Make sure the 12V DC power supply is properly connected.
- Check the 5V Power Selector Jumper.

10.2. Display issues

- Check the connections between the control board and the display unit.
- Make sure the MAX7219 IC is getting power.

10.3. Communication errors

- Check the connections on the DF13 10-pin I/O communication connector.
- Check the connections on the communication connector of the DF13 8-pin keyboard.
- Check the connections on the communication connector of the DF13 8-pin display.
- Make sure the connectors are plugged in correctly.

11. Conclusion

The Flexitimer MX486 is a highly adaptable timing system, suitable for a wide range of applications. By following this user manual, you will be able to install and operate the system efficiently, exploiting its full potential for your timing needs.

For support or additional information, please contact Foxtek Technology Systems or visit our GitHub repository for more programming resources.

Website : www.foxtek.eu

Email : foxtek@gmx.com

Code source : <https://github.com/FoxtekTS/FLEXITIMER>

