MATRIX

MIAC

www.matrixtsl.com

Contents

- PIC MIAC
- Arduino compatible MIAC
- dsPIC MIAC
- Raspberry Pi compatible MIAC
- AllCode compatible MIAC

About this document

This document concerns the various versions of the MIAC (Matrix Industrial Automotive Controller).

1. Trademarks and copyright

PIC and PICmicro are registered trademarks of Arizona Microchip Inc.

AVR is the registered trademarks of the Atmel Corporation.

ARM is the registered trademarks of ARM plc.

E-blocks, Flowcode and MIAC are trademarks of Matrix Technology Solutions Limited.

Arduino is a trademark of Arduino LLC

2. Disclaimer

The information in this document is correct at the time of going to press. Matrix Technology Solutions Limited reserves the right to change specifications from time to time. This product is for development purposes only and should not be used for any life-critical application.

3. Information and technical support

The latest software updates, FAQs and other information can be found on our **website** and **forums**.

General information

The MIAC is a fully specified industrial electronic controller designed to operate with typical industrial control voltages: 0 -10V inputs, up to 24V motor outputs, 240V switching relays.

The MIAC range has 8 analogue or digital inputs, 4 high current relay outputs and 4 solid state outputs. Other interfaces include a fully operational CAN bus interface so that many MIACs can be networked together to form wide area electronic systems. The CAN bus parameters are adjustable, so as to interface to existing networks. Several of the range also feature RS232 and RS485 serial communication interfaces.

Additionally, a Flowcode "MIAC system" allows users without CAN programming experience to rapidly set up complex CAN networked systems using MIAC plus additional add-on modules.

The MIAC is housed in an attractive rugged, anthracite grey plastic moulding. It has two physical mounting options: it can be mounted onto a 35mm 'top hat' DIN rail, or it can be mounted directly onto any surface using the 4 screw holes provided.

The MIAC unit has screw terminal connectors across the top and bottom of the unit, a keypad and display for user control.

MIAC is available in a range of processor platforms to enable use in differing development environments and toolchains, in addition to Flowcode.

Versions overview

MI0235 PIC PIC18F4550 processor module

PIC MIAC

- Keypad (9 keys)
- Eight 10 bit 0-12v Analogue inputs
- Four relay outputs (8A 240V)
- 12 to 16 VDC operating voltage
- 4 line by 16 character LCD display
- Four solid state high current drivers (1.75A total)
- CAN interface
- Application development and simulation with Flowcode IDE
- Application development with C and Assembler

MI5466 AVR ATmega1281 processor module

Arduino compatible MIAC

- Keypad (9 keys)
- Eight 10 bit 0-12v Analogue inputs
- Four relay outputs (8A 240V)
- 9 to 24 VDC operating voltage
- 5 line by 20 character graphic display with backlight illumination
- Four solid state high current drivers (5.6A total)
- Real Time Clock with super-capacitive backup
- Internal microSD card slot
- Serial communications: RS232, RS485 and CAN
- Application development and simulation with Flowcode V7 IDE
- Application development with Arduino IDE
- Versions with additional internal communication module:
  - MI3449 Bluetooth 2.1
  - MI9335 WiFi

MI5809 dsPIC dsPIC33EP256MU806 16 bit processor module

dsPIC MIAC

- Keypad (9 keys)
- Eight 10 bit 0-12v Analogue inputs
- Four relay outputs (8A 240V)
- 9 to 24 VDC operating voltage
- 5 line by 20 character graphic display with backlight illumination
- Four solid state high current drivers (5.6A total)
- Real Time Clock with super-capacitive backup
- Internal microSD card slot
- Serial communications: RS232, RS485 and CAN
- Application development and simulation with Flowcode V7 IDE
- Versions with additional internal communication module:
  - MI8759 Bluetooth 2.1
  - MI8615 WiFi

Versions overview

MI5769 Raspberry Pi compute processor module

Raspberry Pi compatible MIAC

- Keypad (9 keys)
- Eight 10 bit 0-12v Analogue inputs
- Four relay outputs (8A 240V)
- 9 to 24 VDC operating voltage
- 5 line by 20 character graphic display with backlight illumination
- Four solid state high current drivers (5.6A total)
- Real Time Clock with super-capacitive backup
- Internal microSD card slot
- Serial communications: RS232, RS485
- Raspian/Debian RTOS
- Remote online access development
- Cross-compiler development
- MIAC specific interface Kernel modules
- WiFi fitted internally as standard
- Version with additional internal communication module:
  - MI6693 Bluetooth 2.1

MI5331 AllCode dsPIC33EP256MU806 16 bit processor module

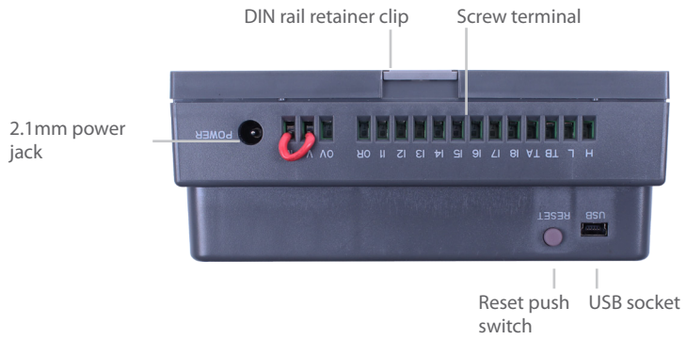
AllCode compatible MIAC

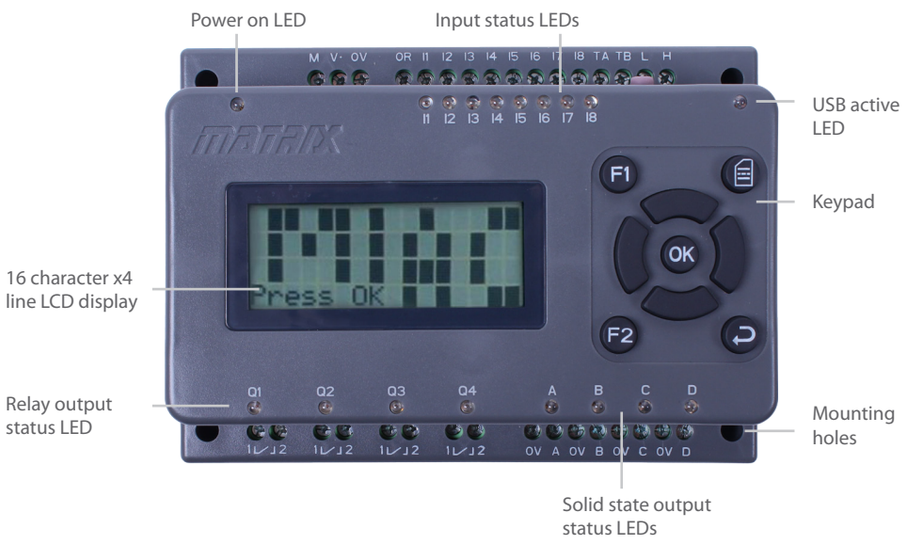
- Keypad (9 keys)
- Eight 10 bit 0-12v Analogue inputs
- Four relay outputs (8A 240V)
- 9 to 24 VDC operating voltage
- 5 line by 20 character graphic display with backlight illumination
- Four solid state high current drivers (5.6A total)
- Real Time Clock with super-capacitive backup
- Internal microSD card slot
- Serial communications: RS232, RS485 and CAN
- API based operation for control from any host system
- Versions with additional internal communication module:
  - MI5528 Bluetooth
  - MI5331 WiFi

Processor	Product Code	Arduino Compatible	dsPIC Module	RPi Module	WiFi Module	Bluetooth Module	WiFi USB Dongle
Arduino	MI5466	✓					
	MI9335	✓			✓		
	MI3449	✓				✓	
dsPIC	MI5809		✓				
	MI8615		✓		✓		
	MI8759		✓			✓	
RPi	MI5769			✓			✓
	MI6693			✓		✓	✓
AllCode	MI3932		✓				
	MI5331		✓		✓		
	MI5528		✓			✓	

Hardware overview

MI0235 (PIC) version only.



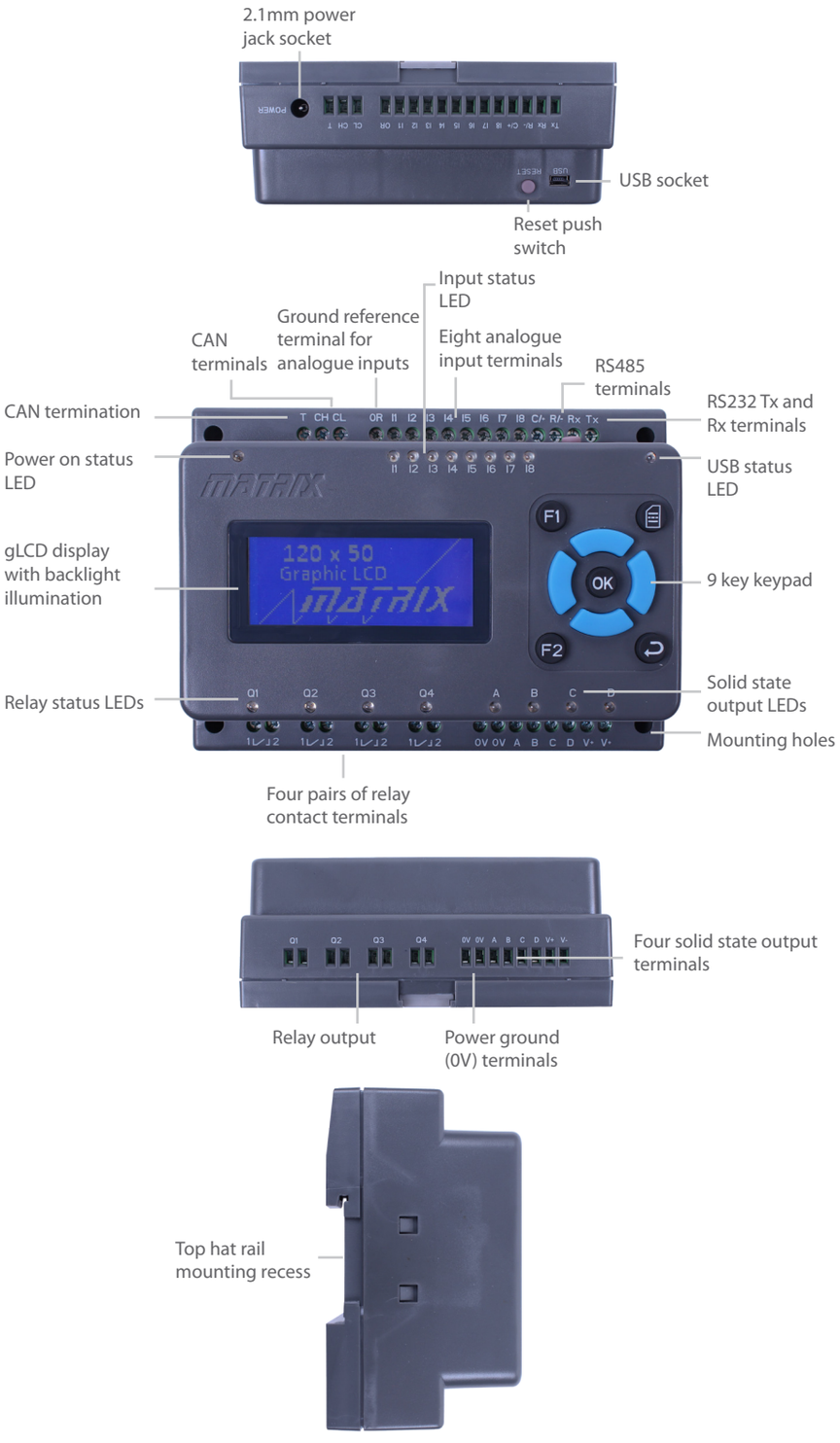


Hardware overview

This page applies to processor module based MIAC versions:

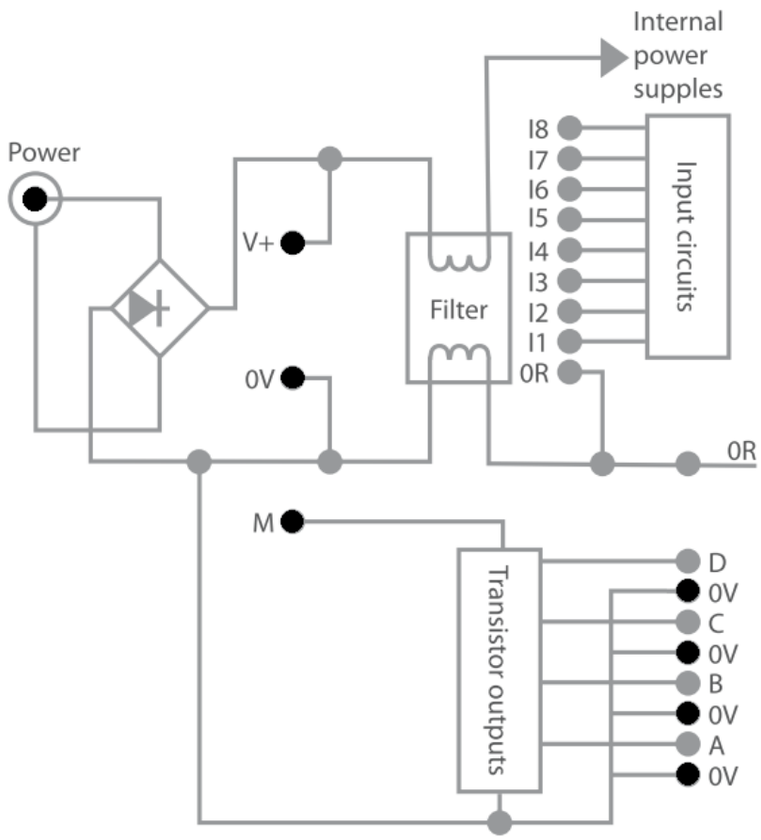
- MI5466, MI9335, MI3449 (ATmega)
- MI5809, MI8615, MI8759, MI5331 (dsPIC)
- MI5769, MI6693 (Raspberry Pi)

It does not apply to the MI0235 (PIC) version



Power supply

This page applies only to the MIAC MI0235 (PIC) version.



The MI0235 8 bit PIC MIAC can be powered with a DC supply voltage in the range 12V to 16V DC. The power can be supplied via the 2.1mm power jack (Power), or the power supply terminals (V+, 0V).

The power jack is fed into a bridge circuit and can therefore accept plugs wired with either connection polarity.

The 0R terminal is the common voltage for the internal logic circuits and is connected to the 0V terminals via the filter.

The transistor outputs are not powered internally. The M terminal is used to apply power to the transistors which allows a voltage other than the supply voltage to be used on the transistor outputs.

The maximum value of M is nominally 12V DC but up to 28V DC can be used depending on the ambient temperature. The transistor outputs are supplied by a single L298 device and can supply up to 500mA each and 1.75A in total. Transistor outputs can be connected in parallel if more power if needed from an output.

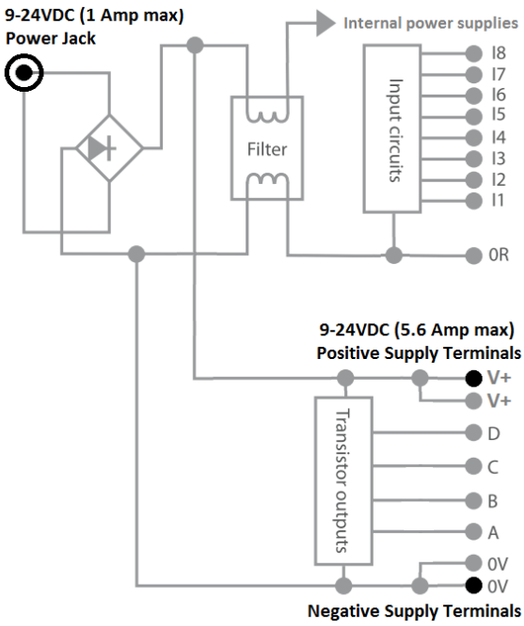
If you wish to power the transistors from the same supply as the supply voltage then simply use a shorting link between the V+ and the M terminals.

Power supply

This page applies to processor module based MIAC versions:

- MI5466, MI9335, MI3449 (ATmega)
- MI5809, MI8615, MI8759, MI5331 (dsPIC)
- MI5769, MI6693 (Raspberry Pi)

It does not apply to the MI0235 (PIC) version



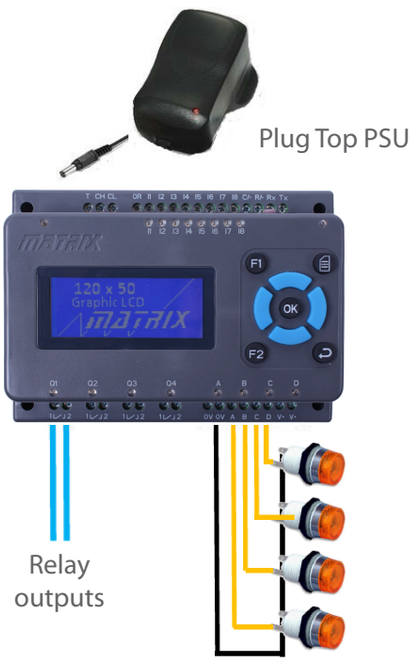
These MIAC versions can be powered with a DC supply voltage in the range 9V to 24V DC.

The recommended power supply connection is via the terminals marked V+ and 0V.

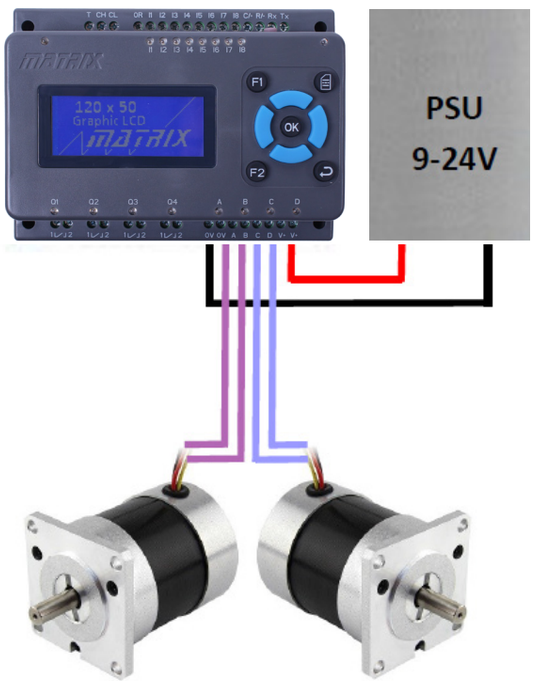
For total power supply current below 1 Amp the power supply can alternatively be provided via the 2.1mm power jack socket. In this case the supply is routed through a bridge rectifier circuit and can therefore accept plugs wired with either connection polarity.

When driving highly inductive loads ensure that transients (such as current through the flyback diodes) do not cause the supply voltage to exceed 30V.

Example of low current usage



Example of high current usage

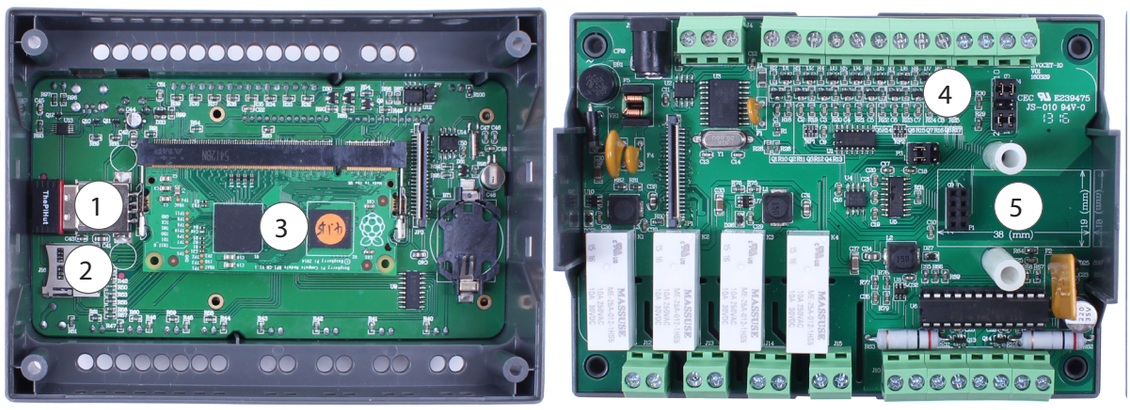


Internal options

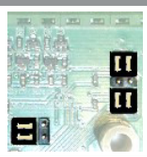
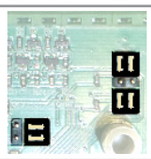
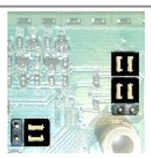
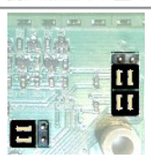
This page applies to processor module based MIAC versions:

- MI5466, MI9335, MI3449 (ATmega)
- MI5809, MI8615, MI8759, MI5331 (dsPIC)
- MI5769, MI6693 (Raspberry Pi)

It does not apply to the MI0235 (PIC) processor version



1. USB WiFi Dongle (Raspberry Pi version only)
2. SD card slot
3. Processor module
4. Serial communication options selectors (see table below)
5. Optional wireless communication module

C/+	R/-	Rx	Tx	Wireless Module	Link Positions
UART1 RS485 A+	UART1 RS485 B-	UART0 RS232 Rx	UART0 RS232 Tx		
UART0 RS232 CTS	UART0 RS232 RTS	UART0 RS232 Rx	UART0 RS232 Tx		
UART0 RS232 CTS	UART0 RS232 RTS	UART0 RS232 Rx	UART0 RS232 Tx	UART1 Rx/Tx	
UART1 RS485 A+	UART1 RS485 B-			UART0 Rx/Tx	

Programming with Flowcode

The easiest way to program a user application into a MIAC is to use Flowcode (V7 or later).

Using Flowcode also has the added advantage of being able to simulate your application on screen before deployment to the target hardware. This option applies to the PIC, dsPIC and AVR versions.

The Microchip PIC versions of the MIAC require the installation of a USB driver. Download the driver zip from the Matrix resource site and unzip to a temporary location. Connect the MIAC via USB cable to your Windows PC. The new device will be detected, cancel the Windows search and install the driver from the temporary directory.

The AVR ATmega version of MIAC requires the installation of the Windows USB FTDI drivers. Connect the MIAC via USB cable to your Windows PC and power it. The new device will be detected and the FTDI drivers should be installed automatically.

MI0235 PIC

Create a new project in Flowcode by selecting "New Embedded Project", then choose "8 bit PIC" target. Select "Misc" from the drop combo box, then select "MIAC V2" from the displayed list. If you intend to build a MIAC System using Addon modules, then select "MIAC System". Start your project by adding a "MIAC (PIC)", from the "Matrix Hardware" component menu, onto to the System or Dashboard panel.

MI5809, MI8615, MI8759 dsPIC

Create a new project in Flowcode by selecting "New Embedded Project", choose "16 bit PIC", then select "Misc" from the drop combo box. Select "MIAC (dsPIC)" from the displayed list. If you intend to build a MIAC System using Addon modules, then select "MIAC (dsPIC) System". Start your project by adding a "MIAC (dsPIC)", from the "Matrix Hardware" component menu, onto to the System or Dashboard panel.

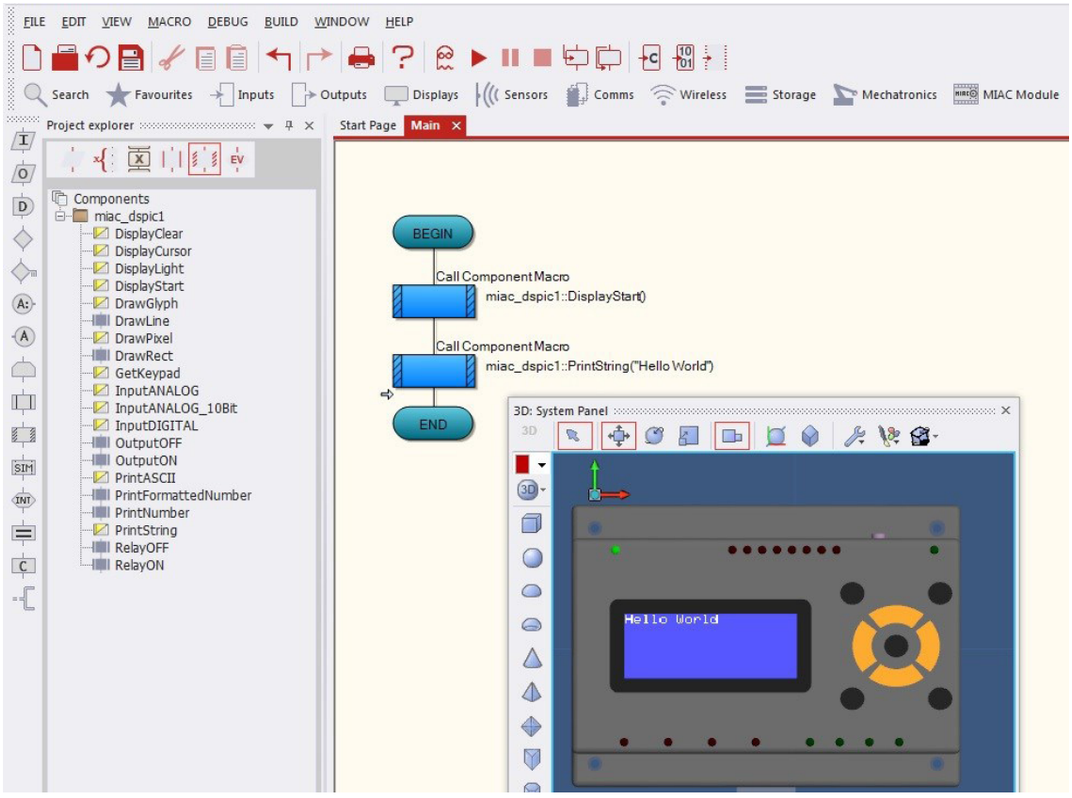
MI5466, MI9335, MI3449 AVR (Arduino Compatible)

Create a new project in Flowcode by selecting "New Embedded Project", choose "Arduino", then select "Misc" from the drop combo box. Select "MIAC (Arduino-Compatible)" from the displayed list. If you intend to build a MIAC System using add-on modules, then select "MIAC (Arduino-Compatible) System". Start your project by adding a "MIAC (Arduino-Compatible)", from the "Matrix Hardware" component menu, onto to the System or Dashboard panel.

Programming with Flowcode

The "Project explorer" window will list the macros that are available for use with the MIAC.

For example: drag "DisplayStart" and "PrintString" to the flowchart as shown, click the Play icon to simulate this simple application.



To deploy your project to the PIC and dsPIC versions of MIAC, connect via USB cable and power the MIAC.

Click the "Compile to Chip" icon.

Press the Reset button on the MIAC when requested to do so.

To deploy your project to the AVR (Arduino-Compatible) versions of MIAC, connect via USB cable and power the MIAC. The USB communication port will be detected and listed in the Project Options dialog box. Select it as your default connection.

Click the "Compile to Chip" icon.

Flowcode components

The MIAC Flowcode components contains the API/macros for basic functionality of the MIAC, such as display, keypad, inputs and outputs.

The MIAC versions however have many more internal features and these are easily implemented in a user application by adding additional Flowcode components into the project.

These components can be found under their relevant menu groups, or via the search facility.

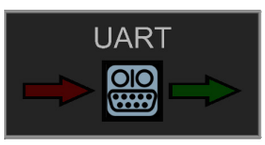
Most of the components listed are MIAC-aware in that their properties will be automatically set to values relevant to the MIAC target version being used.

The list below gives an overview of these additional components and their use. Please see additional online and in-component Flowcode help.

The Real Time Clock component can be added to a project to give read and write access the internal RTC device.

The Serial EEPROM component can be added to a project to give read and write access to the internal non-volatile memory device.

The CAN component is used to access the CAN functionality of MIAC. Note: This is not required for MIAC System projects, as these automatically include all the CAN code that is required.



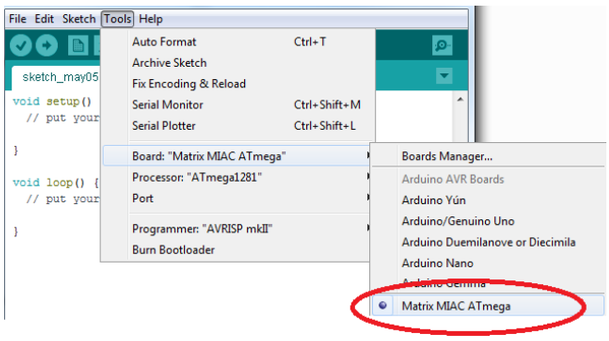
The RS232 component is used to access the RS232 functionality of MIAC. It is a generic UART control component so can also be used to access and control the RS485 UART.

The SD card component can be used to enhance storage capacity of the MIAC when used in conjunction with an optional micro SD card inserted into the internal micro SD card slot.

Using Arduino IDE

The AVR Arduino-Compatible version of MIAC can be programmed from Flowcode or from the Arduino IDE.

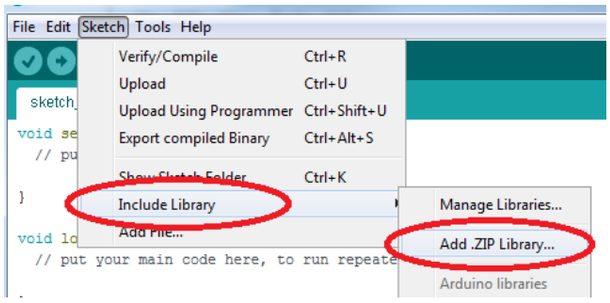
To prepare the Arduino IDE for use with MIAC, first download the MIAC board definition (matrix.zip) and code library (miac.zip) from the matrixtsl resources website.



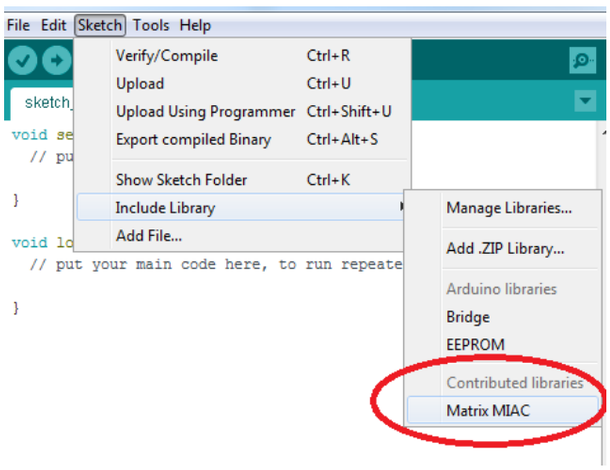
The MIAC board definition needs to be installed by unzipping the matrix.zip contents into the "hardware" installation directory. For example:

"C:\Program Files (x86)\Arduino\hardware\matrix"

The MIAC will now be listed in the "Tools->Board" menu.



The MIAC code library (maic.zip) is installed by using the "Add ZIP Library" feature of the IDE.



The MIAC library can be included in your sketch via the "Sketch->Include Library" menu .

Example MIAC sketches can be seen in the "File->Examples" menu.

Raspberry Pi version

The MI5769 and MI6693 MIAC versions have a 4Gb Compute module that is pre-loaded with the Raspbian operating system, including Python and Node-RED. Additionally, MIAC specific kernel drivers are pre-installed.

A command line interface is provided via the RS232 port at a baud rate of 115200

This can be used for the initial setup of the WiFi system to connect to the users WiFi Access point or router.

Login credentials are the usual user "pi" and password "raspberry".

Additionally, the compute module file systems can be accessed via the MIAC USB interface, for which the Raspberry Pi Foundation provide the rpiboot tool. For Windows use the installer "CM-Boot-Installer".

For detailed instructions see the Raspberry Pi Foundation website.

To access the MIAC file system, connect via USB cable, run "RPi Boot" on the PC and power up the MIAC.

For Windows, tools such as Win32DiskImager can be used to make a complete backup, or restore, of the whole compute file system memory.

The pi user home directory contains the MIAC.py module that simplifies Python code access to the MIAC features, such as display, keypad, inputs and outputs. This is pre-installed to run with Python that also makes use of the pre-installed kernel modules that provide device drivers.

The display (output) and keypad (input) is available via the device node /dev/mdk and hence can also be used by shell script. For example: echo "Hello Word" > /dev/md

The Raspberry Pi MIAC also comes pre-installed with Node-RED.

Node-RED is a flow-based development tool for visual programming developed originally by IBM for wiring together hardware devices, APIs and online services as part of the Internet of Things. Node-RED provides a web browser-based flow editor, which can be used to create JavaScript functions. Elements of applications can be saved or shared for re-use. The runtime is built on Node.js.

The flow editor can be seen in a browser connected to the MIAC via WiFi. To create a flow simply drag nodes from the pallet onto the window and connect with wires by dragging from the node connection points.

See the Matrix TSL "HP0176 MIAC Raspberry Pi Getting Started Guide" for further details

Raspberry Pi version

Before first use of the MIAC, the Wi-Fi system and regional information must be configured.

In its factory default state, the MIAC provides terminal access via the RS232 connections at 115,200 baud.

Connect the RS232 serial port to a PC and run a Terminal Emulator on the PC.

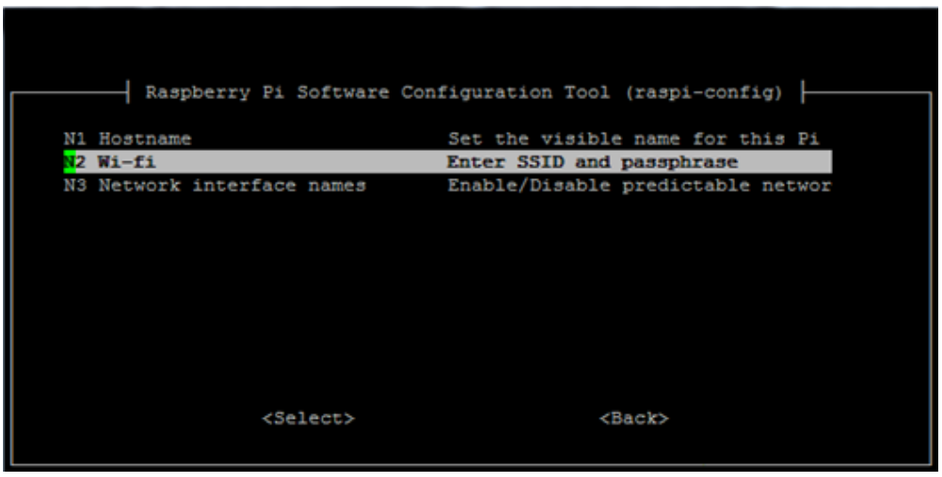
At the login prompt enter user "pi" and password "raspberry" (both without the quotes)

Then run the raspi-config setup utility to configure the system, by typing the command:

```
sudo raspi-config
```

Press the Down key to select "4 Localisation Options" and press the Enter key. At each option configure the system for your Locale, Time zone and Wi-fi configuration.

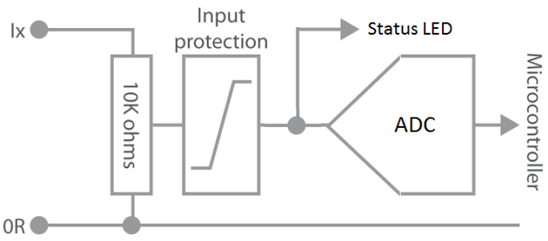
Press the Esc key to return to the main menu and select "2 Network Options", then select "N2 Wi-fi" to configure the Wi-Fi to access your access point.



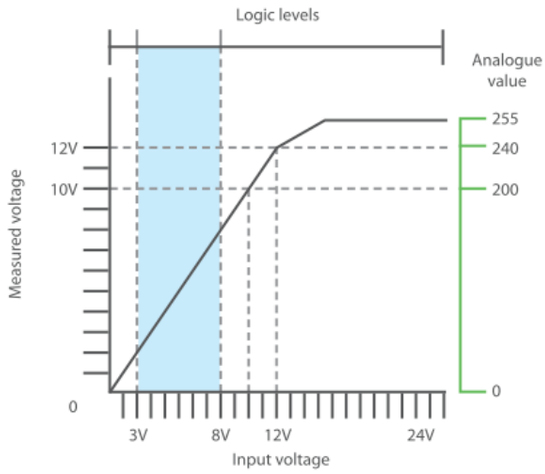
Alternatively, the Wi-Fi access can be setup by editing the wpa_supplicant.conf file on the boot sector. See the previous section regarding use of the "RPi Boot" utility to access the boot sector from a Windows PC. The wpa_supplicant.conf file contents should contain your country and Wi-Fi login credentials:

```
country=GB
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
network={
  ssid="your_ssid"
  psk="your_passkey"
}
```

Input circuits



Schematic of each input



Analogue input conversion

MIAC has eight analogue inputs channels (I1 to I8) with an input voltage range of 0V to 24V, and an input resistance of 10K ohms to 0R. Analogue conversion accuracy is maintained between 0V and 12V.

Analogue conversions have a resolution of 50mV (20 counts per Volt). This allows simple calculations to be used to convert the results of an analogue sample into a direct voltage representation - simply divide the input by 20. Analogue conversion of input voltages above 12V will return the value of the clamping voltage (between 241 and 255).

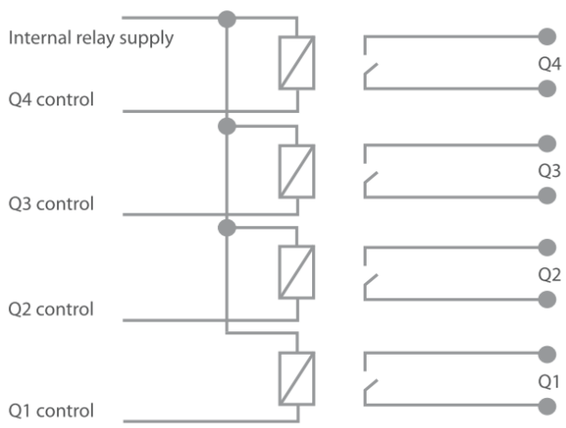
The input resistance allows most industrial PNP output sensors to be used without additional load resistors. It can also be used as part of a potential divider in conjunctions with other sensing devices (thermistors, light dependent resistors etc.).

The input resistance will affect voltages measured from signals with a high output impedance or a low current capacity. Signal sources must be capable of supplying 0.1mA per Volt of signal. Analogue voltage measurements from a source with an output resistance, Rs, will be reduced by a factor of

10K/(10K + Rs). To achieve accurate analogue measurements, signals sources should be obtained from low resistance or buffered sources.

In the case of the MI0235 MIAC PIC version, the internal processor ADC peripheral channels are used, hence these inputs have dual use as digital inputs too. For all other MIAC versions an external ADC convertor is used, hence only inputs 1 and 2 are also connected to logic level inputs for faster input reading of sensors such as quadrature encoders. Logic level switching occurs at input voltages between 3 and 8V DC. The logic levels are undefined for input voltages between the two logic levels: Logic 0: < 3V DC, Logic 1: > 8V DC

Output circuits



All in the MIAC range have four, single-pole, normally open relays, Q1 to Q4.

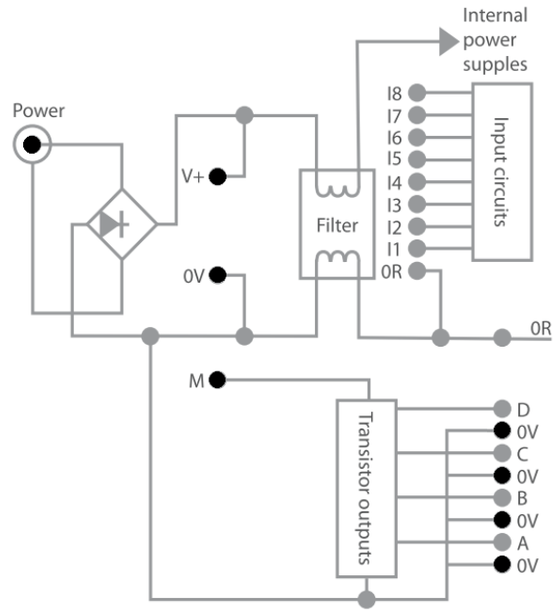
Pairs of terminals provide access to the switch contacts of each relay.

The four pairs of relay contacts are isolated from each other, and from the MIAC control circuitry.

The relays are independently controlled by the MIAC. Each can switch up to 8A at 250VAC or 30VDC.

In order to retain the high isolation and low resistance switching properties of the relays, no protection devices have been added to the contact circuits. Care should be taken when switching loads that could exceed the voltage or current ratings of the contacts.

Solid state outputs of the MIAC MI0235 (PIC) version only



The MI0235 8 bit PIC MIAC transistor outputs are not powered internally. The M terminal is used to apply power to the transistors which allows a voltage other than the supply voltage to be used on the transistor outputs.

The maximum value of M is nominally 12V DC but up to 28V DC can be used depending on the ambient temperature. The transistor outputs are supplied by a single L298 device and can supply up to 500mA each and 1.75A in total. Transistor outputs can be connected in parallel if more power if needed from an output.

If you wish to power the transistors from the same supply as the supply voltage then simply use a shorting link between the V+ and the M terminals.

Output circuits

This page applies to processor module based MIAC versions:

- MI5466, MI9335, MI3449 (ATmega)
- MI5809, MI8615, MI8759, MI5331 (dsPIC)
- MI5769, MI6693 (Raspberry Pi)

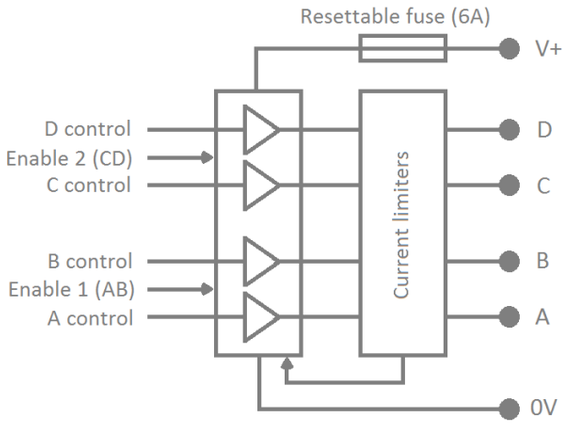
It does not apply to the MI0235 (PIC) version

The processor module range of MIAC have four solid state outputs supplied by a DMOS dual full bridge driver (L6206). The operating supply voltage (V+) is from 9V to 24V DC.

Typical output on resistance is 0.5 ohms. The outputs have over-current detection and protection, thermal shutdown and integrated free wheeling diodes.

The four outputs can be used independently or as two full bridge drivers. Outputs A and B form one bridge and outputs C and D form another bridge. Each bridge can be independently enabled, or controlled by PWM, and each output can source or sink current.

All four outputs have a status LED.



Maximum allowable solid state output currents:

Output driving high, load to 0V	Maximum A and B combined total source current	2.8 Amps
Output driving high, load to 0V	Maximum C and D combined total source current	2.8 Amps
Output driving low, load to V+	Maximum A and B combined total sink current	2.5 Amps
Output driving low, load to V+	Maximum C and D combined total sink current	2.5 Amps
Load between A and B, full bridge mode	Maximum current (A:B)	2.5 Amps
Load between C and D, full bridge mode	Maximum current (C:D)	2.5 Amps

Processor port and pin map

This page applies to processor module based MIAC versions:

- MI5466, MI9335, MI3449 (ATmega)
- MI5809, MI8615, MI8759, MI5331 (dsPIC)
- MI5769, MI6693 (Raspberry Pi)

It does not apply to the MI0235 (PIC) version

Name	Notes	Raspberry Pi			dsPIC	ATmega
SDA0	EEPROM	GPIO0	SDA0	ALT0	31 (SDA2)	26 (D1)
SCL0		GPIO1	SCL0	ALT0	32 (SCL2)	25 (D0)
SDA1	RTC	GPIO2	SDA1	ALT0	31 (SDA2)	26 (D1)
SCL1		GPIO3	SCL1	ALT0	32 (SCL2)	25 (D0)
I1_INT	Input 1 logic	GPIO4		I	16 (RB0)	33 (G0)
I2_INT	Input 2 logic	GPIO5		I	15 (RB1)	34 (G1)
GD_LED	gLCD backlight	GPIO6		O	33 (RP99) (F3)	43 (G2)
CS_ADC	ADC/CAN	GPIO7	SPI0_CE1_N	ALT0	14 (RB2)	7 (E5)
CS_CAN		GPIO8	SPI0_CE0_N	ALT0	13 (RB3)	8 (E6)
MISO0		GPIO9	SPI0_MISO	ALT0	5 (SDI2)	13 (B3)
MOSI0		GPIO10	SPI0_MOSI	ALT0	6 (SDO2)	12 (B2)
SCLK0		GPIO11	SPI0_SCLK	ALT0	4 (SCK2)	11 (B1)
MOTOR_1	MOTORS	GPIO12	PWM0	ALT0	58 (RP96) (F0)	17 (PB7)
MOTOR_2		GPIO13	PWM1	ALT0	58 (RP96) (F0)	14 (PB4)
TXD0	UART0 RS232 Optional WiFi or Bluetooth	GPIO14	TXD0	ALT0	60 (RP80) (E0)	3 (E1)
RXD0		GPIO15	RXD0	ALT0	61 (RPI81) (E1)	2 (E0)
CTS0		GPIO16	CTS0	ALT3	47 (RC13)	61 (F0)
RTS0		GPIO17	RTS0	ALT3	48 (RC14)	60 (F1)
CS_SD	microSD card	GPIO18	SPI1_CE0_N	ALT4	12 (RB4)	9 (E7)
MISO1		GPIO19	SPI1_MISO	ALT4	2 (RPI86)	13 (B3)
MOSI1		GPIO20	SPI1_MOSI	ALT4	3 (RP87)	12 (B2)
SCLK1		GPIO21	SPI1_SCLK	ALT4	1 (RP85)	11 (B1)
DB0	gLCD/Keypad	GPIO22		I/O	21 (RB8)	35 (C0)
DB1		GPIO23		I/O	22 (RB9)	36 (C1)
DB2		GPIO24		I/O	23 (RB10)	37 (C2)
DB3		GPIO25		I/O	24 (RB11)	38 (C3)
DB4		GPIO26		I/O	27 (RB12)	39 (C4)
DB5		GPIO27		I/O	28 (RB13)	40 (C5)
DB6		GPIO28		I/O	29 (RB14)	41 (C6)
DB7		GPIO29		I/O	30 (RB15)	42 (C7)
	UART1 RS485 Optional WiFi or Bluetooth	GPIO30	n/c			
RTS1		GPIO31	RTS1	ALT5	8 (RG9)	19 (G4)
TXD1		GPIO32	TXD1	ALT5	64 (RP84) (E4)	28 (D3)
RXD1		GPIO33	RXD1	ALT5	63 (RPI83) (E3)	27 (D2)
GD_RS	gLCD	GPIO34		O	42 (RD8)	27 (D2)
GD_RW		GPIO35		O	43 (RD9)	30 (D5)
GD_EN		GPIO36		O	44 (RD10)	31 (D6)
GD_RT		GPIO37		O	45 (RD11)	32 (D7)
RELAY_1	RELAYS	GPIO38		O	46 (RD0)	51 (A0)
RELAY_2		GPIO39		O	49 (RD1)	50 (A1)
RELAY_3		GPIO40		O	50 (RD2)	49 (A2)
RELAY_4		GPIO41		O	51 (RD3)	48 (A3)
MOTOR_A	MOTORS	GPIO42		O	52 (RD4)	15 (PB5)
MOTOR_B		GPIO43		O	53 (RD5)	16 (PB6)
MOTOR_C		GPIO44		O	54 (RD6)	5 (PE3)
MOTOR_D		GPIO45		O	55 (RD7)	6 (PE4)

Technical specifications

	MI0235 (PIC)	MI5466, MI9335, MI3449 (AVR), MI5809, MI8615, MI8759 (dsPIC), MI5769, MI6693(RPi), MI5331 (Allcode)
Power supply voltage range	12V-16V DC	9V-24V DC
Power supply internal current consumption	100mA-200mA	50mA-250mA
Inputs	8	8
Inputs working voltage range	0V-12V DC	0V-12V DC
Inputs maximum voltage range	-30V, +45V	-30V, +35V
Input impedance	10K	10K
Relay outputs	4	4
Relay contact rating (resistive load)	8A @ 240VAC, 30VDC	8A @ 240VAC, 30VDC
Solid state outputs	4	4
Solid state o/p source current (max)	500 mA	2.8 A
Solid state o/p sink current (max)	500 mA	2.5 A
Solid state o/p total source current (max)	1.75 A	5.6 A
Solid state o/p total sink current (max)	1.75 A	5 A
Operating temperature range	-5 to 50C	-5 to 50C
Storage temperature range	-40 to +70C	-40 to +70C
IP rating	20	20
Programming interface	USB	USB (WiFi, Bluetooth, depending on model)
Communication	CAN	CAN, RS232, RS485 (WiFi, Bluetooth, depending on model)
Certification	CE certification: EN 60950-1: 2001+A11: 2004 EN 55022: 2006 Class B EN 55024: 1998+A1: 2001+A2: 2003 FCC certification: ANSI C63.4 (2003) CISPR 22: 1997+A1: 2000 ICES-003: 2004	CE certification: EN 60950-1: 2006+A2: 2013 EN 55032: 2015 EN 55024: 2010+A1: 2015 EN 300 328 v1.9.1 EN 301 489-1 v1.9.2 EN 301 489-17 v2.2.1 EN 62479: 2010 FCC certification: ANSI C63.4 : 2014 47 CFR PART 15 Subpart B: 2016 ICES-003: 2016

Warnings

The MIAC unit can operate with hazardous voltages which can result in electric shock or other potentially fatal injuries. Disconnect all power sources before working on equipment.

Do not operate the equipment with case open. Avoid all contact with the connector terminals when any power sources are connected.

Ensure all wiring is in good condition and correctly terminated.

Do not use in safety-critical applications.

8-bit PIC MIAC MI0235 connection

Section	Name	Processor	Notes
Inputs	I1	RA0	
	I2	RA1	
	I3	RA2	
	I4	RA4	
	I5	RE0	
	I6	RE1	
	I7	RE2	
	I8	RB2	
Relay Outputs	Q1	RB4	
	Q2	RB5	
	Q3	RB6	
	Q4	RB7	
Transistor Outputs	A	RC2	PWM Channel 1
	B	RC0	
	C	RC1	PWM Channel 2
	D	RC6	
	Enable	RB3	
LCD Display	D4	RD5	
	D5	RD4	
	D6	RD3	
	D7	RD0	
	RS	RD1	
	E	RD6	
Keypad	Column 1	RD0	
	Column 2	RD1	
	Column 3	RD2	
	Row A	RD3	
	Row B	RD4	
	Row C	RD5	
CAN	SDI	RB0	
	SDO	RC7	
	SCK	RB1	
	CS	RD7	
	INT	RA4	

Regulatory Compliance and Safety Information for MIAC

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

---Reorient or relocate the receiving antenna.
---Increase the separation between the equipment and receiver.
---Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
---Consult the dealer or an experienced radio/TV technician for help.

WARNING: Changes or modifications not expressly approved by Matrix TSL could void the user's authority to operate the equipment.

RF Exposure

The equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with minimum distance 20cm between the radiator & your body.

The following products contain transmitter module FCC ID: 2AHMR-ESP12S

- MI9335 – Arduino-compatible MIAC with WiFi
- MI8615 – dsPIC MIAC with WiFi
- MI5331 – AllCode MIAC with WiFi

The following products contain transmitter module FCC ID: A8TBM77SPPSYC2A

- MI3449 – Arduino-compatible MIAC with Bluetooth
- MI8759 – dsPIC MIAC with Bluetooth
- MI6693 – Raspberry Pi MIAC with WiFi and Bluetooth

The following products contain transmitter module FCC ID: 2AHRD-EPN8531

- MI5769 – Raspberry Pi MIAC with WiFi
- MI6693 – Raspberry Pi MIAC with WiFi and Bluetooth

CE Conformity

The products covered by this guide are intended to be used in all EU member countries, Norway, and Switzerland. Products been tested and found to comply with the requirements for a Class B device pursuant to European Council Directive 2014/30/EU (EMC) and 1999/5/EC (R&TTE), thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA).

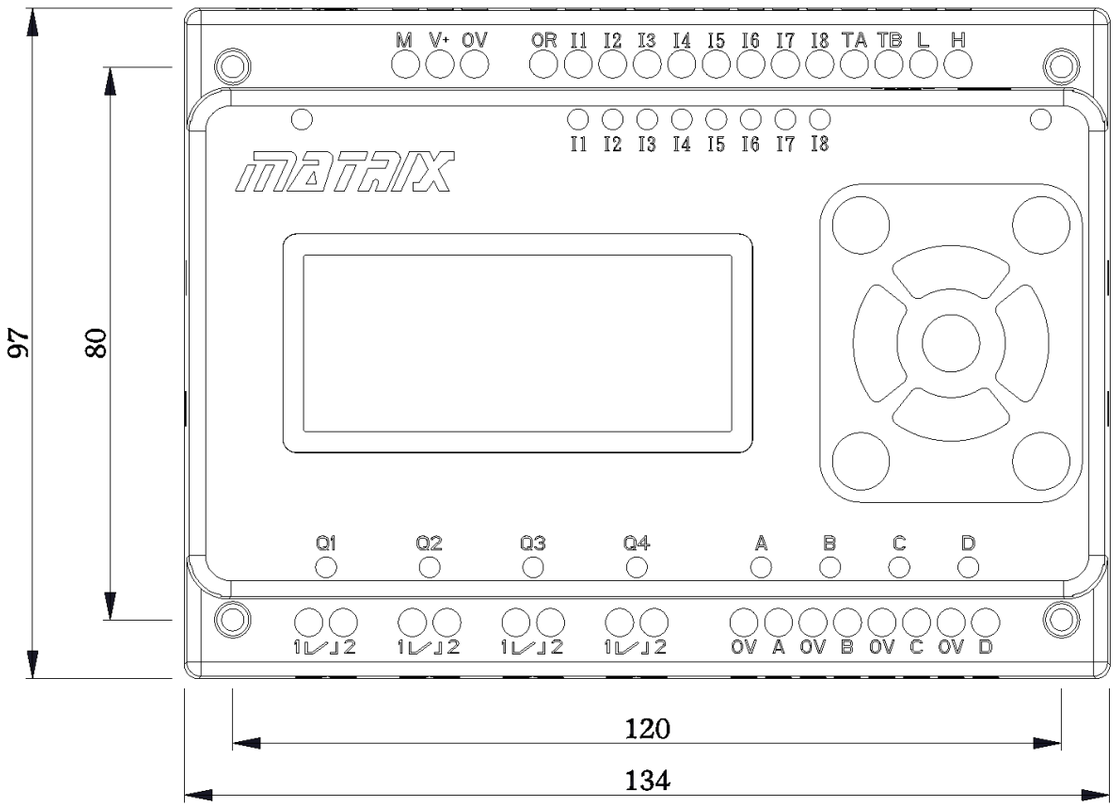
Restriction of Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)

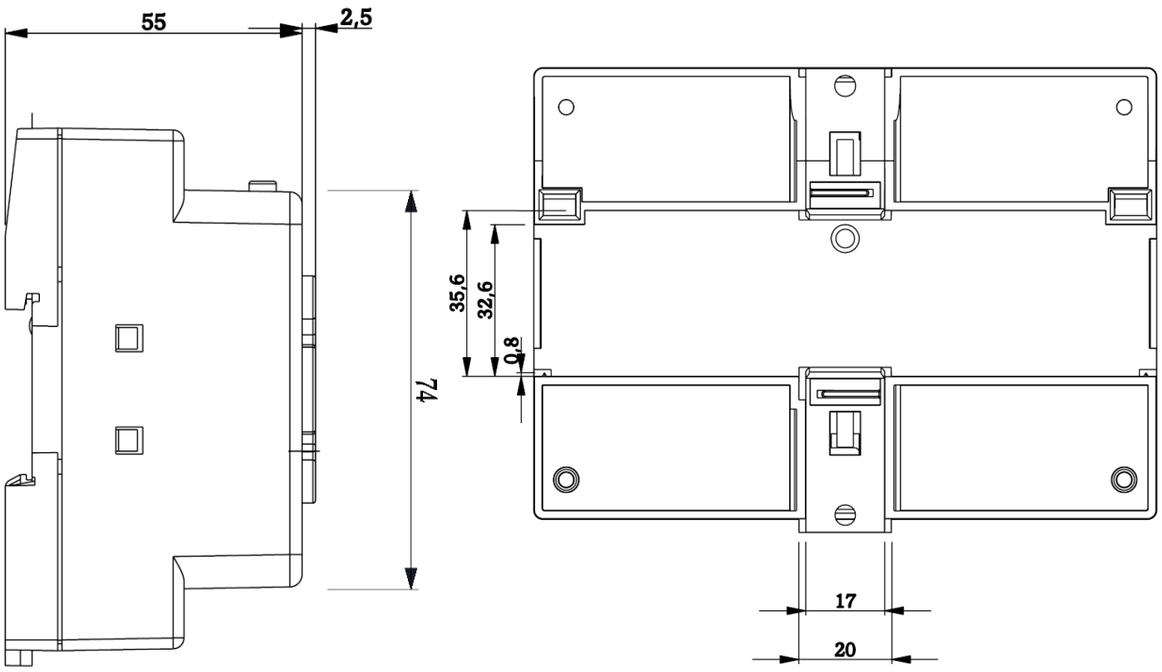
MIAC complies in all material respects with DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive) and Amendment 2005/618/EC filed under C(2005) 3143.

Waste Electrical and Electronic Equipment (WEEE)

For product recycling instructions and more information, please go to www.matrixtsl.com

Case dimensions





Version control

Version	Author	Date	Changes
1.0	LN	20/07/2016	Document creation
1.1		12/07/2017	Page 5 information update



Matrix Technology Solutions Ltd.
33 Gibbet Street
Halifax
HX1 5BA

t: +44 (0)1422 252380
e: sales@matrixtsl.com

www.matrixtsl.com

MIAC-60-3.1