



M-Duino 19R/38R/57R User Guide:

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COMPACT PLC.



2 General Description M-DUINO R FAMILY product



INDUSTRIAL SHIELDS

A compact PLC based in Open Source Hardware technology. With different Input/Outputs Units.

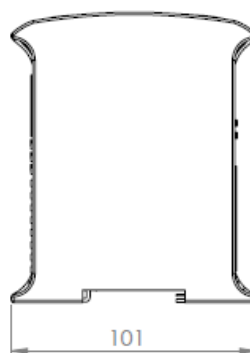
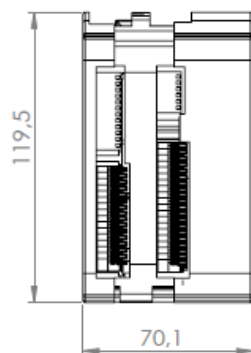
CONECTABLE PLC ARDUINO 24Vcc M-DUINO R				
MODEL TYPE	19R I/Os	38R I/Os	57R I/Os	
Input Voltage	12- 24Vdc			Fuse protection (1A) Polarity protection
I max.	0,5A			
Size	101x119.5x70.1	101x119.5x94.7	101x119.5x119.3	
Clock Speed	16MHz			
Flash Memory	256KB of which 8KB used by bootlader			
SRAM	8KB			
EEPROM	4KB			
Communications	I2C ¹ – Ethernet Port – USB – RS485 – RS232 -- SPI – (2x) Rx,Tx (Arduino pins)			Max232-Max485-W5100
TOTAL Input points	6	12	18	
TOTAL Output points	14	28	39	
Type of signals				
An/Dig Input 10bit (0-10Vcc)(5/12/24Vdc)	4	8	12	0-10V / 5/12/24Vdc Input Impedance: 39K Separated PCB ground
Digital Isolated Input (24Vdc)	0	0	0	5/12/24Vdc I min: 2/6/12 mA Galvanic ISOLATION
* Interrupt isolated Input HS (24Vdc)	2	4	6	5/12/24Vdc I min: 2/6/12 mA Galvanic ISOLATION
Analog Output 8bit (0-10Vcc)	3	6	8	0-10 Vdc I max: 40 mA Separated PCB ground
Digital Isolated Output Relay	8	16	23	220V Vac I max: 5 A Galvanic ISOLATION Diode Protected for Relay
PWM Isolated Output 8bit (24Vdc)	3	6	8	5/12/24 Vdc I max: 0.3 A Galvanic ISOLATION Diode Protected for Relay
Expandability	I2C - 127 elements - Serial Port RS232/RS485			

¹ Pull-up resistance required ([IS.AC12C-4.7K](#))

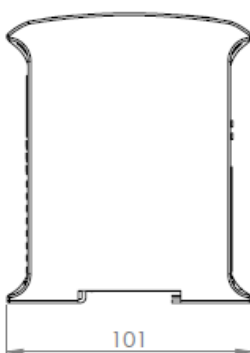
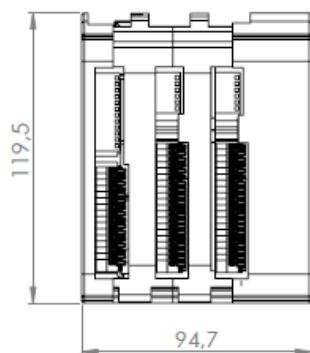


Reference	IS.MDUINO.base.21	IS.MDUINO.base.42	IS.MDUINO.base.58	
* When using Interrupt, standard digital input is disabled.				
(1) IMPORTANT. Visit accessories/communication section.				

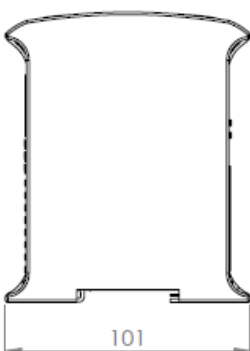
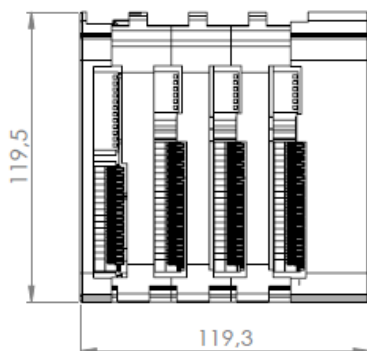
2.1 Mechanical dimension



M-Duino 19R I/Os



M-Duino 38R I/Os



M-Duino 57R I/Os



3 Precautions

3.1 Arduino Board

All M-duino family products use Arduino MEGA Board.

3.2 Intended Audience

This manual is intended for technicians, which must have knowledge on electrical systems.

3.3 General Precautions

The user must operate M-Duino according to the performance specifications described in this manual.

Before using M-Duino under different conditions from the what is specified in this manual or integrating M-Duino to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your INDUSTRIAL SHIELDS representative. Ensure that the rating and performance characteristics of M-Duino are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment double safety mechanisms. This manual provides information for programming and operating the M-Duino.



Warnings:

- Unused pins should not be connected. Ignoring the directive may damage the controller.
- Improper use of this product may severely damage the controller.
- Refer to the controller's User Guide regarding wiring considerations.

Before using this product, it is the responsibility of the user to read the product's User Guide and all accompanying documentation.



4 Specifications

4.1 General Specifications:

Item		M-DUINO 19R IOs	M-DUINO 38R IOs	M-DUINO 57R IOs
Power supply voltage	DC power supply	12 - 24Vdc		
Operating voltage range	DC power supply	11.4 to 25.4Vdc		
Power consumption	DC power supply	30VAC max.		
External power supply	Power supply voltage	24Vdc		
	Power supply output capacity	700Ma		
Insulation resistance		20MΩ min.at 500Vdc between the AC terminals and the protective earth terminal.		
Dielectric strength		2.300 VAC at 50/60 HZ for one minute with a leakage current of 10mA max. Between all the external AC terminals and the protective earth terminal.		
Shock resistance		80m/s ² in the X, Y and Z direction 2 times each.		
Ambient temperature (operating)		0° to 45°C		
Ambient humidity (operating)		10% to 90% (no condensation)		
Ambient environment (operating)		With no corrosive gas		
Ambient temperature (storage)		-20° to 60°C		
Power supply holding time		2ms min.		
Weight		445g max.	542g max.	850g max.

4.2 Performance Specification:

Item	M-DUINO 19R IOs	M-DUINO 38R IOs	M-DUINO 57R IOs
Arduino Board	ARDUINO MEGA 2560		
Control method	Stored program method		
I/O control method	Combination of the cyclic scan and immediate refresh processing methods.		
Programming language	Arduino IDE. Based on wiring (Wiring is an Open Source electronics platform composed of a programming language. "similar to the C". http://arduino.cc/en/Tutorial/HomePage		
Microcontroller	ATmega2560		
Flash Memory	256kb of which 8 kb used by bootloader		
Program capacity (SRAM)	8kb		
EEPROM	4kb		
Clock Speed	16MHz		
Clock Speed	16MHz		

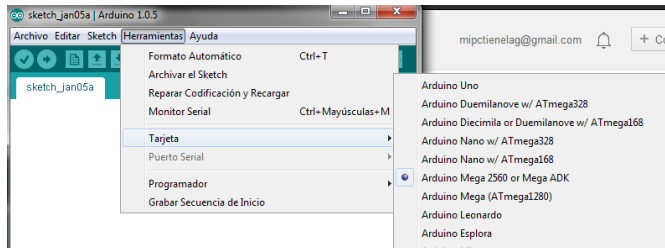


5 Before to connect:

5.1 Software interface

Industrial Shields programming environment is Arduino IDE.

<https://www.arduino.cc/en/Main/Software>



You can download start code for M-Duino at www.industrialshields.com, section *Ethernet PLCs /M-Duino / Document files*.

5.2 How to connect PLC Arduino to PC

- Connect USB port from PLC to PC.

NOTE:

M-Duino Family use USB-B cable.



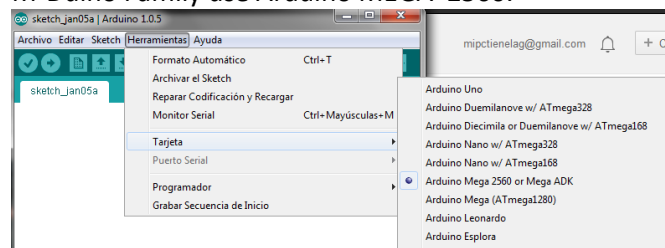
- Open Arduino IDE interface:
You can install with this link:

<http://arduino.cc/download.php?f=/arduino-1.0.6-windows.exe>

- Select Arduino Board

NOTE:

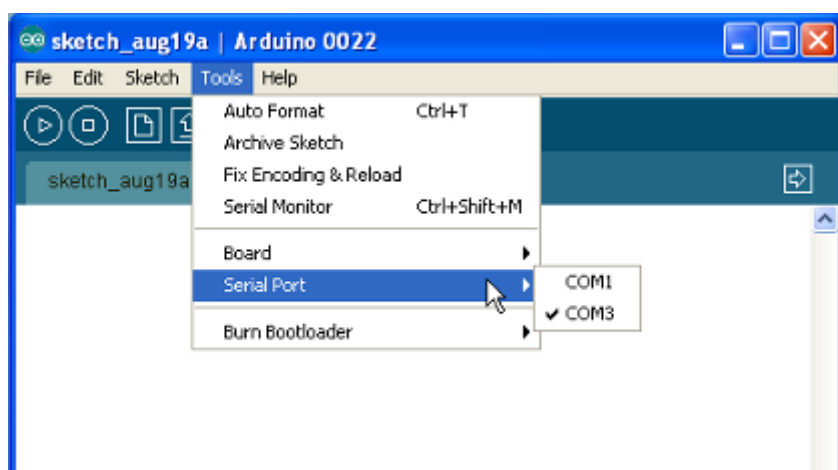
M-Duino Family use Arduino MEGA 2560.



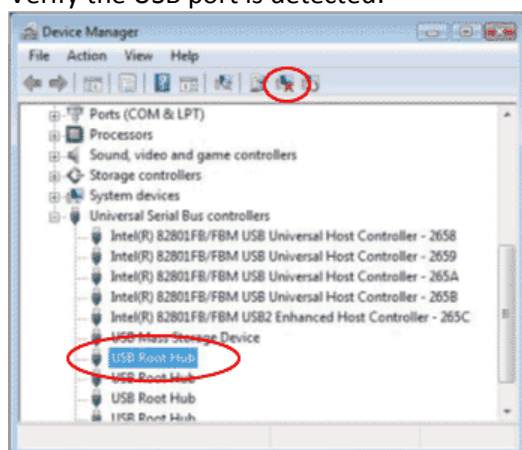
- IMPORTANT: For M-duino Family you need set the *AUTORESET* switch to on when uploading the program to Arduino Mega 2560).



- Select correct port.



IMPORTANT:
Verify the USB port is detected:





5.3 How to connect PLC to power supply

- MDuino Family PLC are 12-24Vdc supplied. IMPORTANT: The polarity IS NOT REVERSAL!
- Ensure that the live and GND connector of the power supply match the PLC.
- Ensure that the power supply mains output is not higher than 24Vdc.



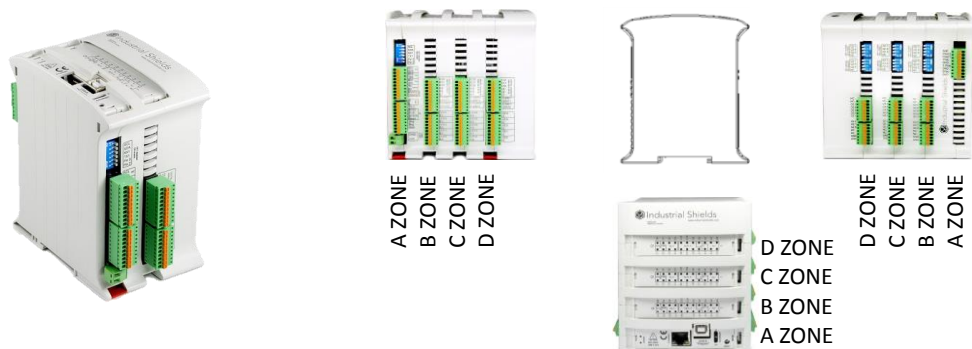
- Suggested power suppliers



* Not recommended for industrial applications. The *Jack* connector needs to be removed and use the live and GND connectors.

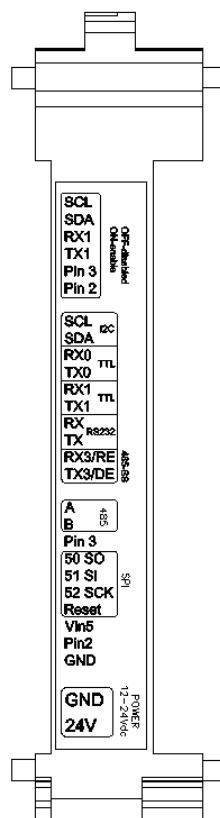


6 M-duino 19R/38R/57R I/O Pinout:



6.1 A Zone connection 19R/38R/57R I/Os)

Base (common unit)		
A Zone		
M-Duino Connector	Arduino Pin	Function
SCL	21	I2C/SS
SDA	20	I2C/SS
RX0	1	RX0/SS
TX0	0	TX0/SS
RX1	19	RX1/SS
TX1	18	TX1/SS
RX	17	RX2(serial 2)
TX	16	TX2(serial 2)
RX3/RE	15	RX3/RS485/SS
TX3/DE	14	TX3/RS485/SS
A	-	RS485
B	-	RS485
PIN3	3	Arduino Pin/ Select SPI
50 SO	50	SPI
51 SI	51	SPI
52 SCK	52	SPI
Reset	Reset	SPI
Vin5	Vin5	SPI
PIN2	2	Arduino Pin/ Select SPI
GND	-	Gnd
24Vdc	-	Gnd



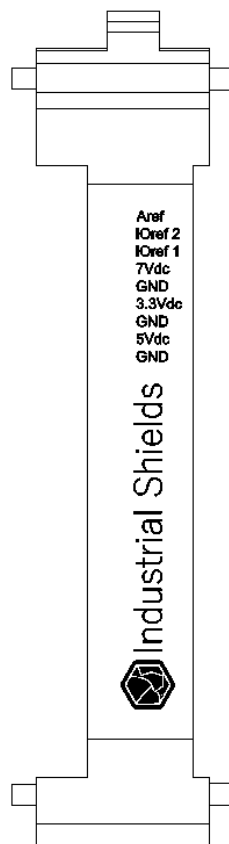
Configuration Switch* (see section 8 for Communications configuration.
Enabling Communications disable s some I/Os)

Communication Pinout

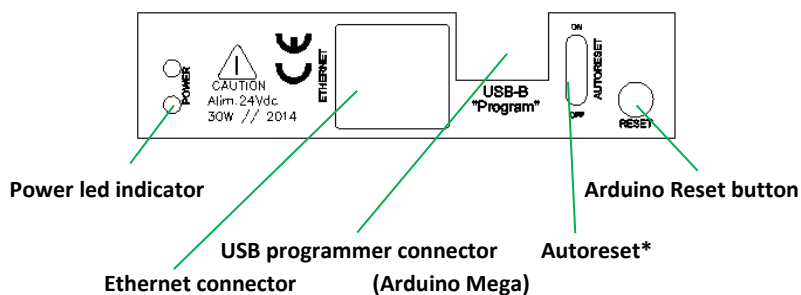
Power supply connectors
(24Vdc – Gnd)



Base (common unit)		
A Zone		
M-Duino Connector	Arduino Pin	Function
AREF	AREF	Arduino PIN
IOREF2	IOREF2	Arduino PIN
IOREF1	IOREF1	Arduino PIN
7Vdc	7Vdc	-
Gnd	Gnd	GND
3.3Vdc	3.3Vdc	Arduino PIN
GND	Gnd	GND
5Vdc	5Vdc	-
GND	Gnd	GND



6.2 A Zone top (19R/38R/57R I/Os)

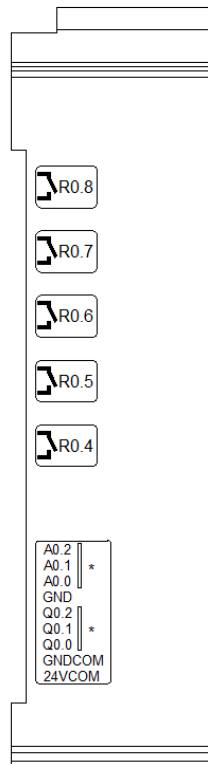


**NOTE: Autoreset. Arduino mega has auto reset when using serial communication code. Set switch to OFF when using serial communication. When uploading code to Arduino Mega set switch to ON.*



6.3 B Zone (19R/38R/57R I/Os)

B Zone		
M-Duino Connector	Arduino Pin	Function ²
R0.8	37	Relay Out
R0.7	38	Relay Out
R0.6	39	Relay Out
R0.5	40	Relay Out
R0.4	24	Relay Out
A0.2 ²	6	Analog Out
A0.1 ²	5	Analog Out
A0.0 ²	4	Analog Out
GND	GND	GND
Q0.2 ²	6	Digital/PWM Out
Q0.1 ²	5	Digital/PWM Out
Q0.0 ²	4	Digital/PWM Out
GNDCOM	--	External Isolated Out Gnd
24VCOM	--	External Isolated Out Vdc

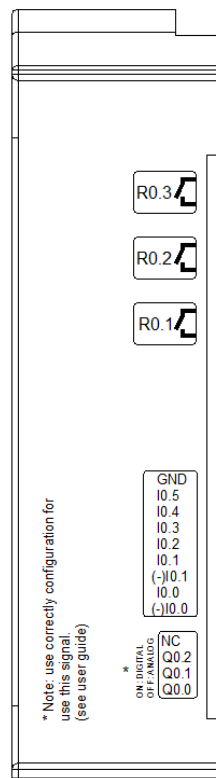


RELAY Outputs

ANALOG Output (Switch Configuration)

DIGITAL/PWM Outputs (isolated)

B Zone		
M-Duino Connector	Arduino Pin	Function ²
R0.3	25	Relay Out
R0.2	22	Relay Out
R0.1	23	Relay Out
GND	GND	GND
I0.5	A3	Analog/Digital Input
I0.4	A2	Analog/Digital Input
I0.3	A1	Analog/Digital Input
I0.2	A0	Analog/Digital Input
I0.1	3	Interrupt 1 In
(-)I0.1	--	GND I0.1
I0.0	2	Interrupt 0 In
(-)I0.0	--	GND I0.0



RELAY Outputs

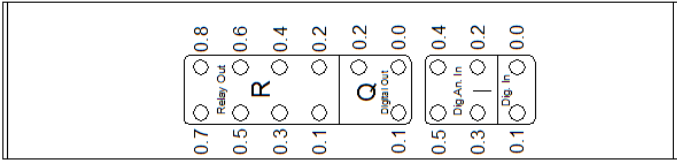
ANALOG/DIGITAL Inputs

INTERRUPT Inputs (isolated)

Configuration Switch*
(see section 8 to select correct configuration for outputs).

² See section 8 to select suitable switch configuration for (10-24Vdc/An-Dig) configurable I/Os.

6.4 B Zone top (19R/38R/57R I/Os)

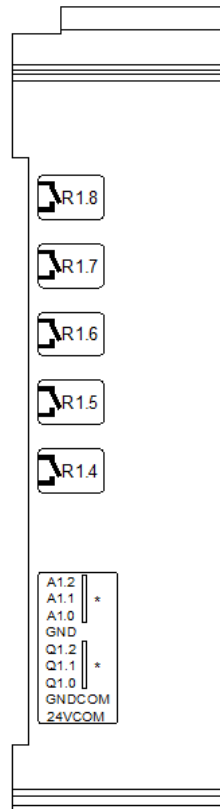


Led indicator I/Os state



6.5 C Zone (38R/57R I/Os)

B Zone		
M-Duino Connector	Arduino Pin	Function ³
R1.8	42	Relay Out
R1.7	43	Relay Out
R1.6	44	Relay Out
R1.5	45	Relay Out
R1.4	29	Relay Out
A1.2 ²	11	Analog Out
A1.1 ²	10	Analog Out
A1.0 ²	8	Analog Out
GND	GND	GND
Q1.2 ²	11	Digital/PWM Out
Q1.1 ²	10	Digital/PWM Out
Q1.0 ²	8	Digital/PWM Out
GNDCOM	--	External Isolated Out Gnd
24VCOM	--	External Isolated Out Vdc

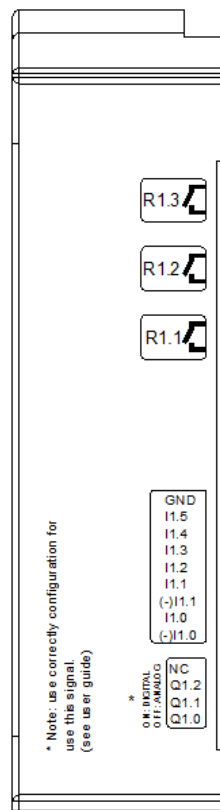


RELAY Outputs

ANALOG Output (Switch Configuration)

DIGITAL/PWM Outputs (isolated)

B Zone		
M-Duino Connector	Arduino Pin	Function ²
R1.3	30	Relay Out
R1.2	27	Relay Out
R1.1	28	Relay Out
GND	GND	GND
I1.5	A9	Analog/Digital Input
I1.4	A8	Analog/Digital Input
I1.3	A7	Analog/Digital Input
I1.2	A6	Analog/Digital Input
I1.1	19	Interrupt 4 In
(-)I1.1	--	GND I1.1
I1.0	18	Interrupt 5 In
(-)I1.0	--	GND I1.0



RELAY Outputs

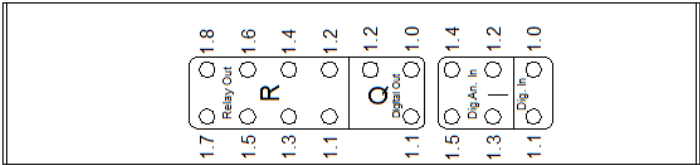
ANALOG/DIGITAL Inputs

INTERRUPT Inputs (isolated)

Configuration Switch*
(see section 8 to select correct configuration for outputs).

² See section 8 to select suitable switch configuration for (10-24Vdc/An-Dig) configurable I/Os.

6.6 C Zone top (37R/57R I/Os)

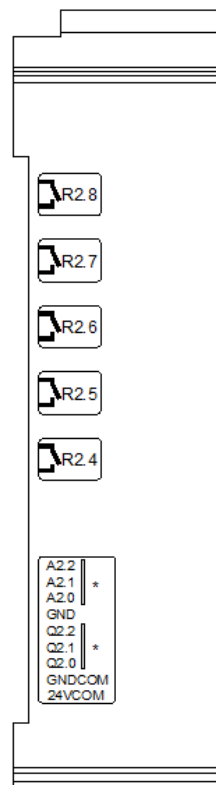


Led indicator I/Os state



6.7 D Zone (57R I/Os)

B Zone		
M-Duino Connector	Arduino Pin	Function ⁴
R2.8	47	Relay Out
R2.7	48	Relay Out
R2.6	49	Relay Out
R2.5	NC	--
R2.4	34	Relay Out
A2.2 ²	NC	--
A2.1 ²	13	Analog Out
A2.0 ²	12	Analog Out
GND	GND	GND
Q2.2 ²	NC	--
Q2.1 ²	13	Digital/PWM Out
Q2.0 ²	12	Digital/PWM Out
GNDCOM	--	External Isolated Out Gnd
24VCOM	--	External Isolated Out Vdc

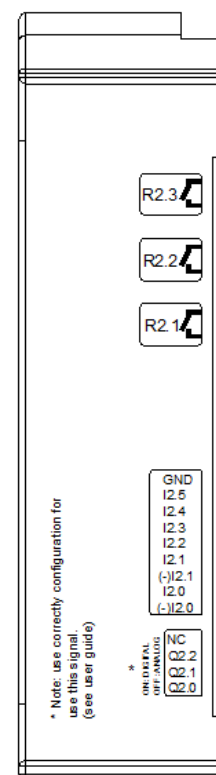


RELAY Outputs

ANALOG Output (Switch Configuration)

DIGITAL/PWM Outputs (isolated)

B Zone		
M-Duino Connector	Arduino Pin	Function ²
R2.3	35	Relay Out
R2.2	32	Relay Out
R2.1	33	Relay Out
GND	GND	GND
I2.5	A15	Analog/Digital Input
I2.4	A14	Analog/Digital Input
I2.3	A13	Analog/Digital Input
I2.2	A12	Analog/Digital Input
I2.1	21	Interrupt 2 In
(-)I2.1	--	GND I2.1
I2.0	20	Interrupt 3 In
(-)I2.0	--	GND I2.0



RELAY Outputs

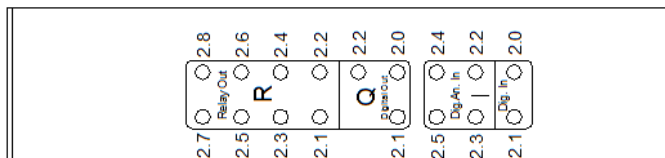
ANALOG/DIGITAL Inputs

INTERRUPT Inputs (isolated)

Configuration Switch*
(see section 8 to select correct configuration for outputs).

² See section 8 to select suitable switch configuration for (10-24Vdc/An-Dig) configurable I/Os.

6.8 D Zone top (58 I/Os)



Led indicator I/Os state

7 M-Duino Arduino I/Os 5V pins

The M-Duino has some of the Mega board pins available. This pins can be programmed according to Arduino features such as I/Os operating at 5V or any additional features present in the pins (for example I2C communication in pins SCL and SDA).

The Arduino board available pins are summarized in the table below. In order to access some of this pins the configuration switch must be set to OFF position (see section 7).

M-Duino terminal	Arduino pin	Enable Arduino pin
SCL	21	Communication switch: OFF
SDA	20	Communication switch OFF
RX0	0	
TX0	1	
RX1	19	Communication switch: OFF
TX1	18	Communication switch: OFF
RX3	15	
TX3	14	
Pin 3	3	Communication switch: OFF
Pin 2	2	Communication switch: OFF

IMPORTANT: Do not connect the terminals in the chart above to voltages higher than 5V. These terminals provide direct access to the Mega board.



8 Switch configuration

8.1 Communications / Interrupt Switch

Arduino Pin	Switch mode OFF	Switch mode ON	M-Duino IOs model		
21	SCL	Interrupt 2		M-Duino 37R IOs	M-Duino 57R IOs
20	SDA	Interrupt 3			
19	Rx1	Interrupt 4			
18	Tx1	Interrupt 5			
3	Pin 3	Interrupt 1	M-Duino 19R IOs		
2	Pin 2	Interrupt 0			

**NOTE: Digital Inputs I0.5, I0.6, I1.5, I1.6, I2.5, I2.6 can be configured on Arduino IDE to be Interrupts.*

IMPORTANT:

To enable communication connections the switches must be set to "OFF". Set to "ON" position to enable I/Os terminals. Communications and I/Os terminals on the chart can not work simultaneously. For example if Pin 3 is enabled (OFF), I0.6 will not be disabled.

Direct connection to Arduino 5V pins

OFF position provides direct connection to Arduino Pin (so they can be programmed according to Arduino pin features either for communication or as I/Os working at 5V).

8.2 Analog / Digital Configuration Switch

RIGHT SIDE		
B-C-D ZONE		
Input	ON	OFF
NC Q0.2 Q0.1 Q0.0	Q0.2 Q0.1 Q0.0	A0.7 A0.6 A0.5
NC Q1.2 Q1.1 Q0.0	Q1.2 Q1.1 Q1.0	A1.2 A1.1 A1.0
NC Q2.2 Q2.1 Q2.0	- Q2.1 Q2.0	- A2.1 A2.0

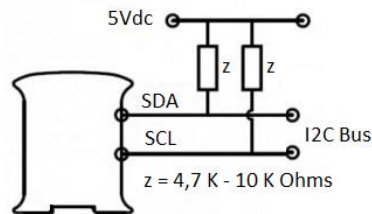
Some Outputs can be configured as Analog/Digital and 10Vdc/24Vdc, the chart above summarizes the positions for each type of configurable Output. If you want a Digital/PWM Out, connect your wire in the "Q" output and put the switch in the "ON" position. If you want a Analog (0-10v) Out, wire in the "A" output and put the switch in the "OFF" position. Is possible that the analog outputs A0.0, A0.1, A0.2, A1.0, A1.1, A1.2 and A2.0 and A2.1 can give signal when the switch is " ON ", is preferable to place it in " OFF " position for a pure 0-10V output.



9 Communications

9.1 I2C

I2C communication requires a pull-up resistor ([IS.ACI2C-4.7K](#))



Check the switch configuration at section 8 to enable I2C port.

9.2 TTL

M-Duino has two TTL ports, RX0/TX0 and RX1/TX1, RX3/TX3.

TTL0 is accessed with the function *Serial* (pins 0 and 1 of the Arduino Mega).

TTL1 is accessed with the function *Serial1* (pins 18 and 19 of the Arduino Mega).

TTL3 is accessed with the function *Serial3* (pins 14 and 15 of the Arduino Mega).

Check the switch configuration at section 8 to enable TTL ports.

9.3 SPI

The M-Duino pins used for the SPI bus are summarized in the table below. For SPI bus MISO, MOSI and CLOCK pins are common to all the connected devices to the M-Duino, conversely, each of the connected devices will have a single and dedicated SS pin.

Function	M-Duino connection	Mega board pin
MISO	50 S0	50
MOSI	51 SI	51
CLOCK	52 SCK	52
Reset	Reset	Reset
SS	SCL/SDA/RX0/TX0/RX1/TX1/RX3/TX3/Pin2/Pin3	21/20/1/0/19/18/15/14/2/3

Check the switch configuration at section 8 to enable SS pins.

9.4 RS-232

The Arduino Mega function code to access the RS-232 port in the M-Duino is *Serial2* (pins 16 and 17 of the Arduino Mega). Check the switch configuration at section 8 to enable RS -232 port.

For an example of RS-232 communication check out Industrial Shields blog.

<http://blog.industrialshields.com/es/2015/08/rs485-and-rs232-implementation-to-in/>



9.5 RS-485

For RS485 communication protocol the defined Arduino Mega pins are showed in the chart below.

RS485 pinout	
Function	Arduino Pin
DI	10
RO	11
RE	15
DE	14

In order to use RS-485 a serial port must be created on pins 14 and 15 using SoftwareSerial function. Following there is a simple Arduino demo sketch which reads a byte from RS-485 port and echoes it back to the RS-485 bus.

```
#define SSerialRX    11 // RO //RS485 Receive pin
#define SSerialTX    10 // DI //RS485 Transmit pin
#define SSerialTxControl 14 // DE //RS485 Direction pin
#define GroundRE     15 // RE
#define RS485Transmit HIGH
#define RS485Receive LOW
SoftwareSerial RS485Serial(SSerialRX, SSerialTX);
void setup() {
  digitalWrite(GroundRE,LOW);
  RS485Serial.begin(4800);
}
void loop() {
  digitalWrite(SSerialTxControl, RS485Receive);
  if (RS485Serial.available()) { // Read from RS485!
    digitalWrite(PinLED, HIGH);
    byteRecv = RS485Serial.read();
    digitalWrite(SSerialTxControl, RS485Transmit);
    RS485Serial.write(byteRecv);
  }
}
```

For another example check Industrial Shields blog

<http://blog.industrialshields.com/es/2015/08/rs485-and-rs232-implementation-to-in/>



9.6 Ethernet

M-Duino Ethernet port controller is based on w5100 IC, which is the compatible IC compatible with Arduino Ethernet Shield libraries. All Ethernet shield Arduino libraries are compatible with the M-DUino.

In the M-Duino, W5100 IC communicates to the Mega board via SPI bus (SS Arduino Mega pin 53).

Before using the M-Duino Ethernet port, the Arduino IDE on the programming PC must be configured according to the following tutorial. The required .h files for the configuration may be download from the same link.

<http://blog.industrialshields.com/es/2015/08/ethernet-shield-libraries/>

All Arduino sketches intending to use Ethernet on the M-Duino must include the following code lines.

```
#define SPI_ETHERNET 53
void setup()
{
  pinMode(SPI_ETHERNET, OUTPUT);
  digitalWrite(SPI_ETHERNET, LOW);
}
void loop()
```

10 I/O technical details:

■ Contact Ratings

Load	High-capacity
Rated load (resistive, p.f.= 1)	5 A at 250 VAC 3 A at 30 VDC
Max. switching voltage	250 VAC, 30 VDC
Rated carry current	5A
Max. switching current	5A (AC load,) 3A (DC load)
Max. switching power	1,250 VA, 90 W

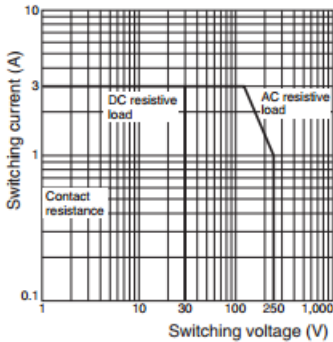
■ Characteristics

Contact resistance (see note 2)	100 mΩ max.										
Operate time	10 ms max.										
Release time	10 ms max.										
Insulation resistance (see note 3)	1,000 MΩ min. (at 500 VDC)										
Dielectric strength	4,000 VAC, 50/60 Hz for 1 min. between coil and contacts 750 VAC, 50/60 Hz for 1 min. between contacts of same polarity										
Impulse withstand voltage	10,000 V (1.2 x 50 μs) between coil and contacts										
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude										
Shock resistance	Destruction: 1,000 m/s ² (approx. 100 G) Malfunction: 100 m/s ² (approx. 10 G)										
Life expectancy	Mechanical: 5,000,000 operations min. (18,000 operations/hour) Electrical: 200,000 operations minimum: <table><tr><td>High-capacity</td><td>Standard</td></tr><tr><td>5 A at 125 VAC</td><td>3 A at 125 VAC</td></tr><tr><td>3 A at 30 VDC</td><td>3 A at 30 VDC</td></tr></table> 100,000 operations minimum: <table><tr><td>High-capacity</td><td></td></tr><tr><td>5 A at 250 VAC</td><td></td></tr></table> All electrical load ratings are resistive, with operation frequency = 1,800 operations/hour.	High-capacity	Standard	5 A at 125 VAC	3 A at 125 VAC	3 A at 30 VDC	3 A at 30 VDC	High-capacity		5 A at 250 VAC	
High-capacity	Standard										
5 A at 125 VAC	3 A at 125 VAC										
3 A at 30 VDC	3 A at 30 VDC										
High-capacity											
5 A at 250 VAC											
Minimum permissible load (reference value) (see note 4)	5 VDC, 10 mA										
Ambient temperature	Operating: -40°C to 70°C (with no icing or condensation)										
Ambient humidity	Operating: 5% to 85%										
Weight	Approx. 4 g										

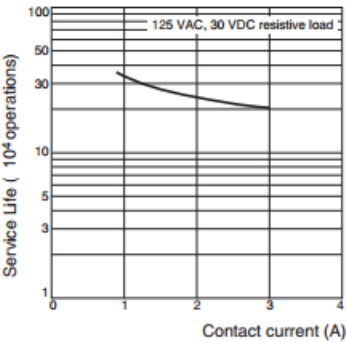
- Note: 1. The data shown above are initial value.
2. Measurement conditions: 5 VDC, 1 A, voltage drop method
3. Measurement conditions: Measured at the same points as the dielectric strength using a 500-VDC ohmmeter.
4. This value is for a switching frequency of 120 operations/minute. (P level: $\lambda_{60} = 0.1 \times 10^{-6}$ operations)

Standard models

Maximum Switching Capacity



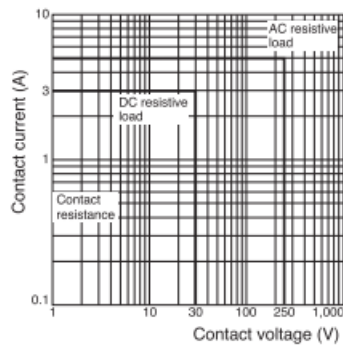
Electrical Service Life



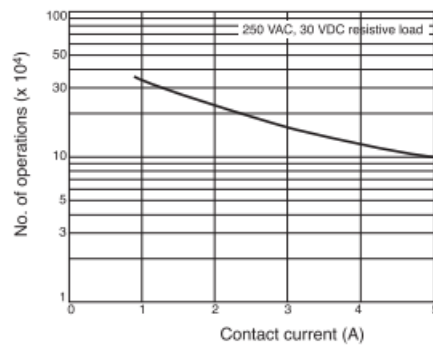


High-capacity models

Maximum Switching Capacity

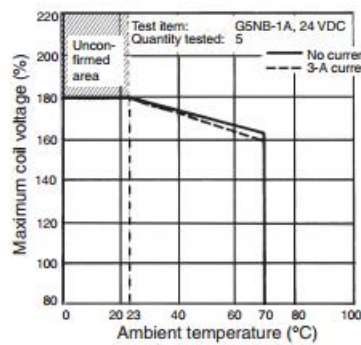


Electrical Service Life



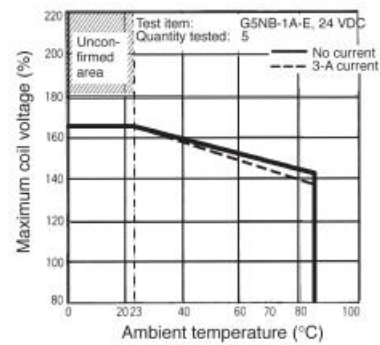
Standard models

Ambient Temperature vs. Maximum Coil Voltage



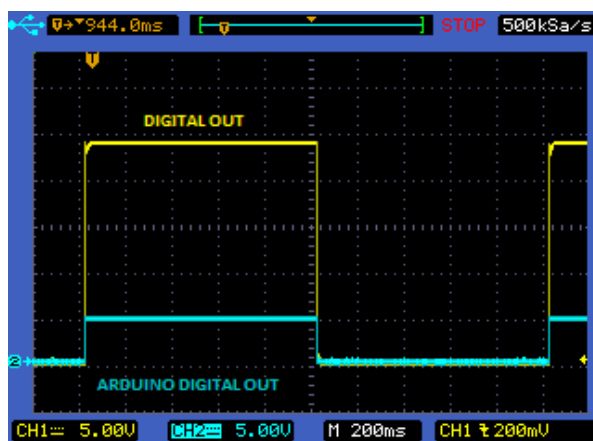
High-capacity models

Ambient Temperature vs. Maximum Coil Voltage



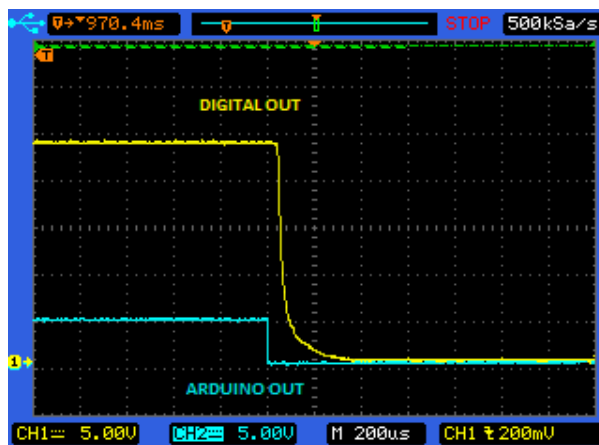
Note: The maximum coil voltage refers to the maximum value in a varying range of operating power voltage, not a continuous voltage.

Digital Output Waveform:

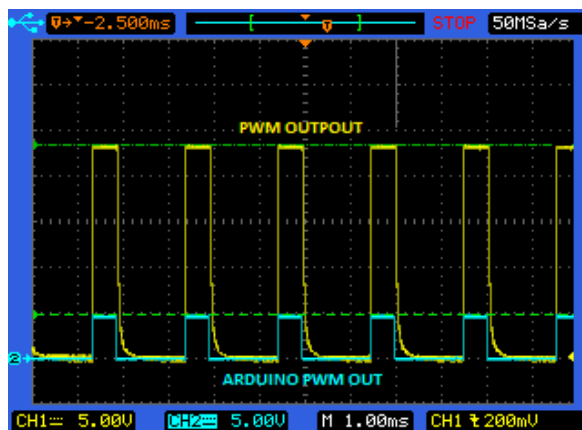




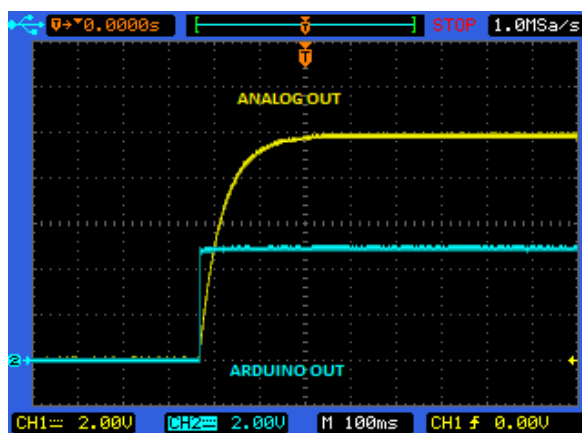
Digital Out-put Turn-off:



PWM Waveform:

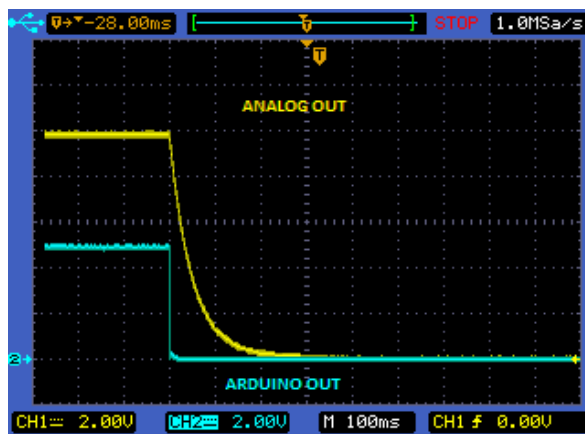


Analog Out Turn On:

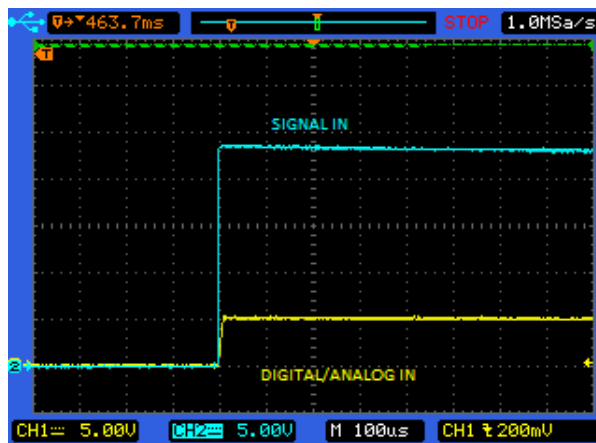




Analog Out Turn-Off:

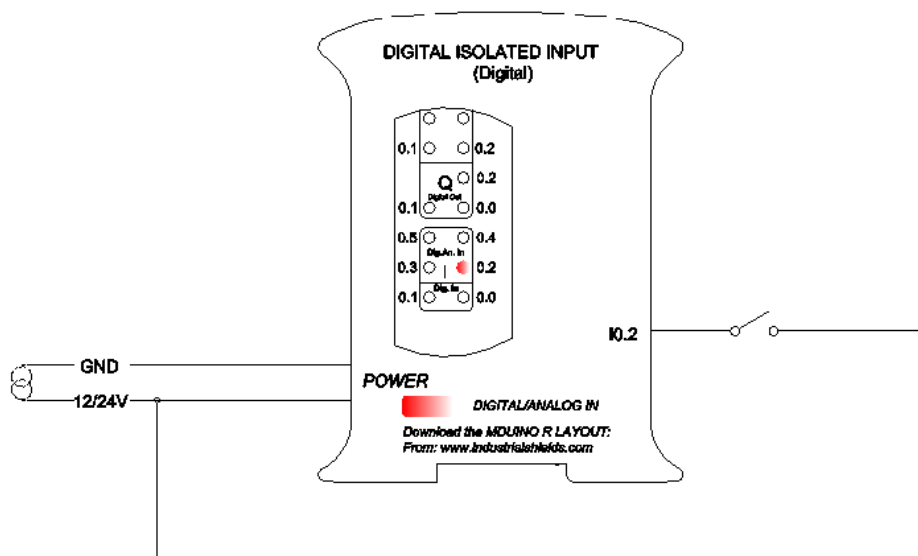
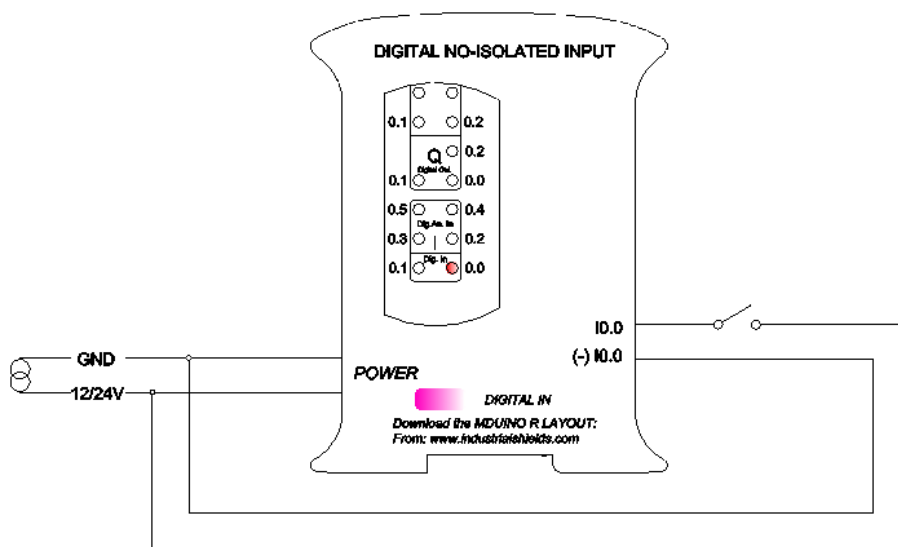
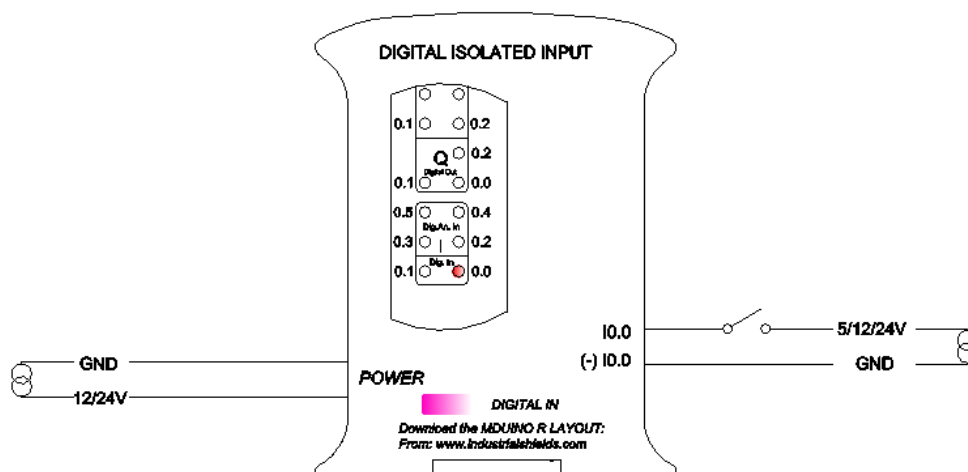


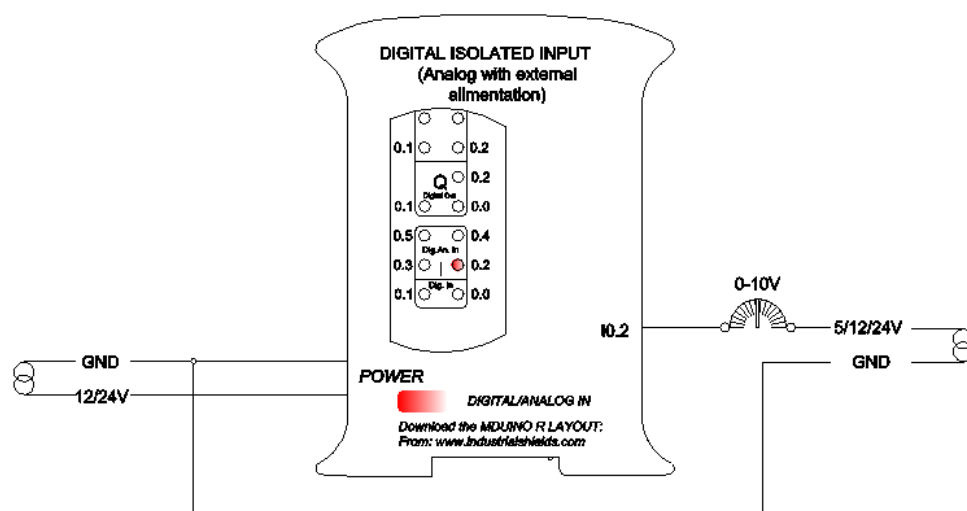
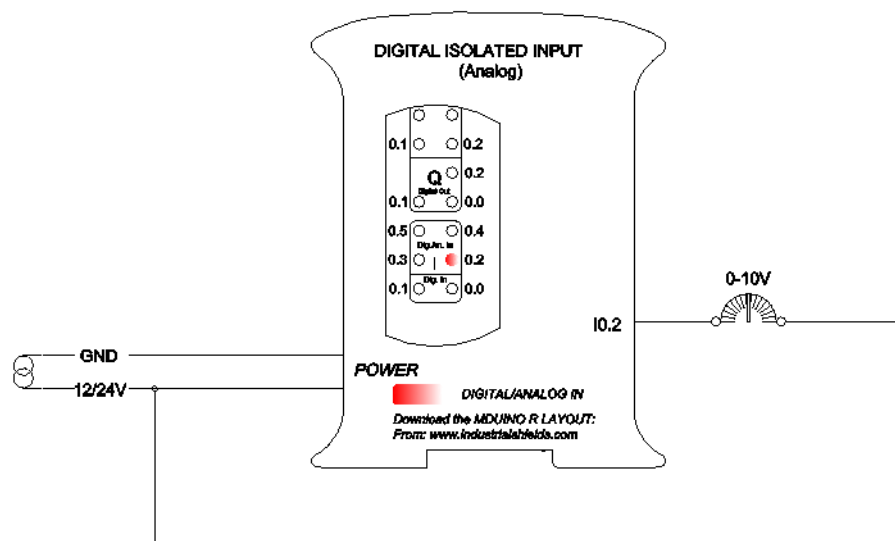
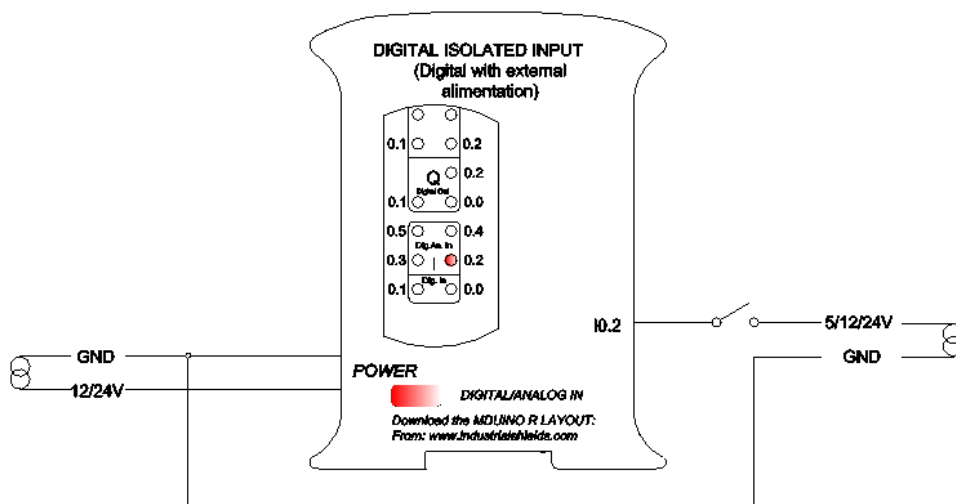
Analog /Digital input Turn-on:

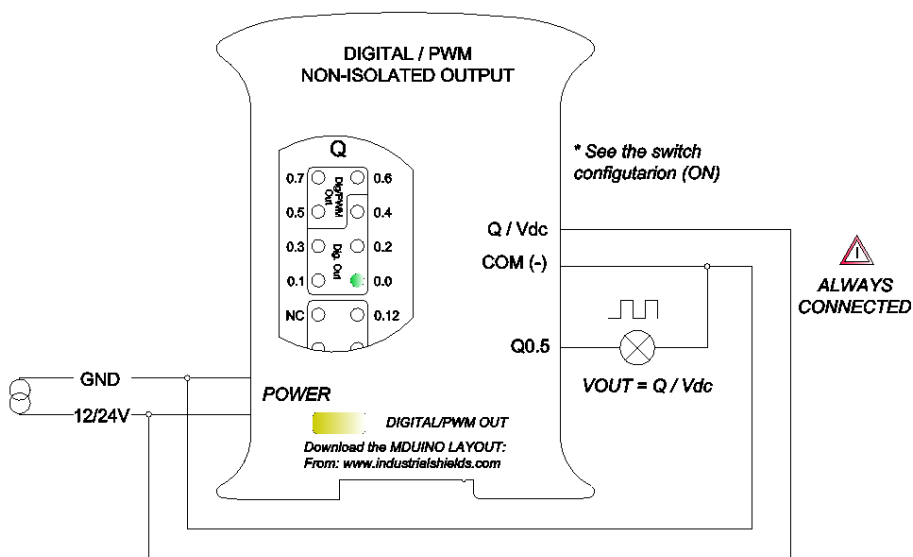
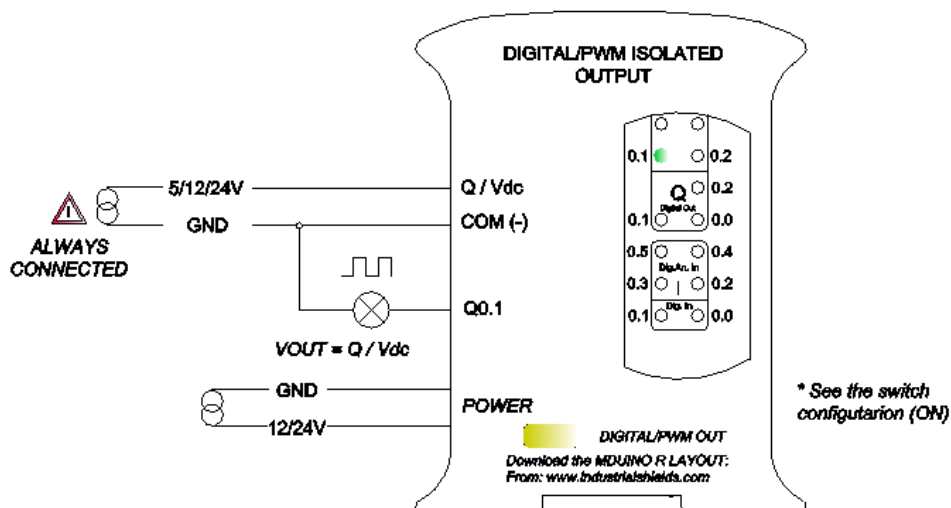
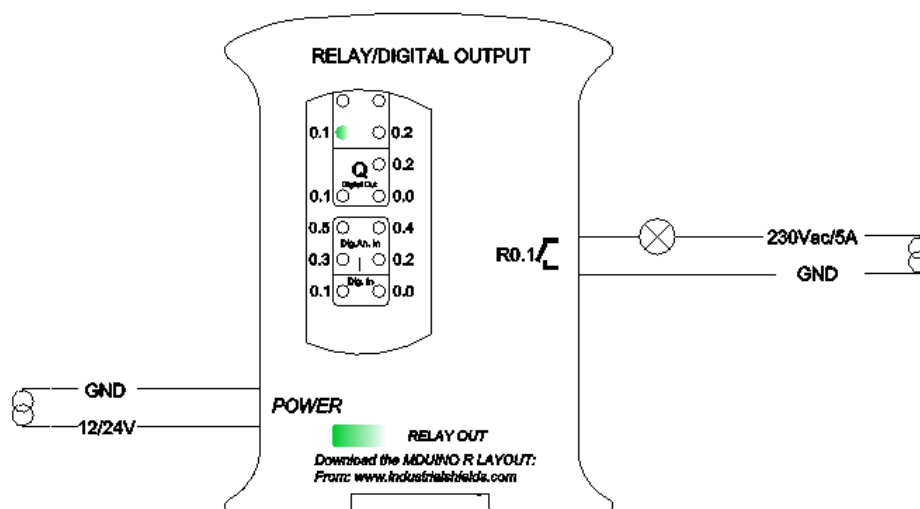


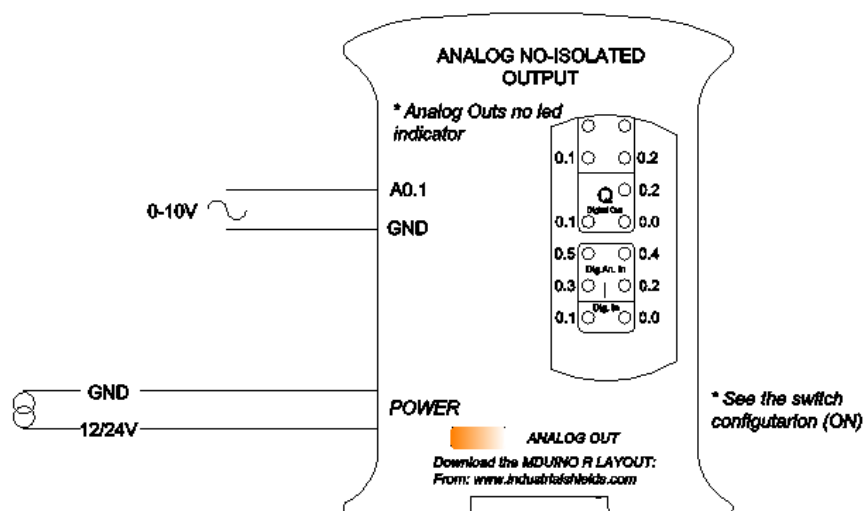


11 Typical Connections











12 Connector details:

The connector inside the PLCs that mounts on the PCB is MC 0,5/10-G-2,5 THT – 1963502 from Phoenix contact. [MC0,5/10-G-2,5THT](#)

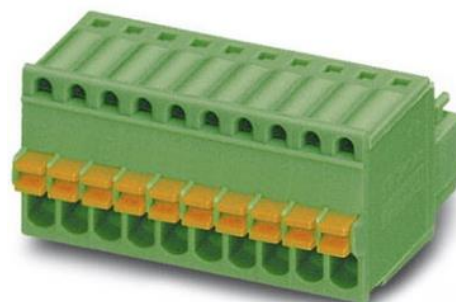
For I/O and power supply there is a FK-MC 0,5/10-ST-2,5 - 1881406 connector from Phoenix contact. [FK-MC 0,5/10-ST-2,5](#)

Connection details:

Article reference	MC 0,5/10-G-2,5 THT
Height	8,1mm
Pitch	2,5mm
Dimension	22,5mm
Pin dimensions	0,8x0,8mm
Pin spacing	2,50mm

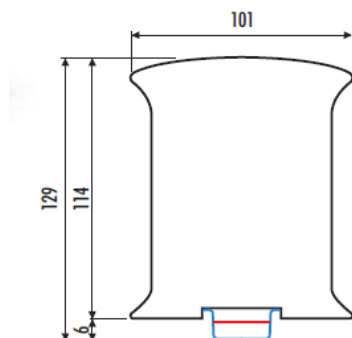


Article reference	FK-MC 0,5/10-ST-2,5
Rigid conduit section min.	0,14 mm ²
Rigid conduit section max.	0,5 mm ²
Flexible conduit section min.	0,14 mm ²
Flexible conduit section max.	0,5 mm ²
Conduit section AWG/kcmil min.	26
Conduit section AWG/kcmil max.	20

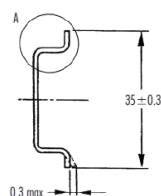
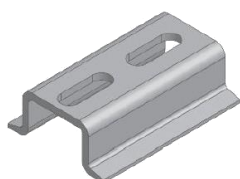


13 Mechanical Characteristics

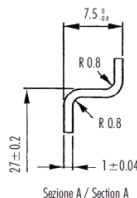
- Dimension M-duino Family:



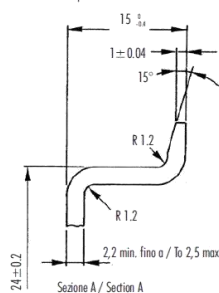
- DIN Rail mounting



Profilato a cappello TH 35-7,5
Top hat rail TH 35-7,5



Profilato a cappello TH 35-15
Top hat rail TH 35-15



CARATTERISTICHE	METODO	UNITA' DI MISURA	BLENDE PC/ABS
Mecchaniche			
Resistenza a trazione allo snervamento	ASTM D638	MPa	68
Resistenza a trazione a rottura	ASTM D638	MPa	48
Allungamento a rottura	ASTM D638	%	57
Modulo di flessione	ASTM D790	MPa	2894
Termiche			
Prova Load con intaglio	ISO 180/14	KJ/m ²	5.5
Temperatura di ricottimento Visc. metodo B	ASTM D1525	°C	114
Temperatura Ricott. 1.81 MPa	ASTM D648	°C	97
Fisiche			
Peso specifico	ASTM D792	g/cm ³	1.21
Efficienza nella stampa	ASTM D955	%	0.4/0.6
Melt Flow Index 260°C - 98N	ASTM D1238	g/10'	11.1
Comportamento alla fiamma			
Autoestinguenza (mm di spessore)	UL94	-	V-0 (0.8)
Filo Incandescente 3.2 mm	IEC60521	°C	960

Industrial Shields si riserva il diritto di modificare il materiale con cui realizza i propri prodotti senza obbligo di preavviso.

FEATURES	TEST METHOD	UNITS	BLENDE PC/ABS
Mechanical test			
Resistance to tensile stress at yield	ASTM D638	MPa	68
Tensile strength	ASTM D638	MPa	48
Ultimate elongation	ASTM D638	%	57
Flexing modulus	ASTM D790	MPa	2894
Thermal test			
Load test method	ISO 180/14	KJ/m ²	5.5
Visual softening temperature method B	ASTM D1525	°C	114
Relaxing temperature 1.81 MPa	ASTM D648	°C	97
Physical test			
Specific gravity	ASTM D792	g/cm ³	1.21
Mold shrinkage	ASTM D955	%	0.4/0.6
Melt Flow Index 260°C - 98N	ASTM D1238	g/10'	11.1
Flame test			
Self extinguisher (thickness in mm)	UL94	-	V-0 (0.8)
Incandescent thread 3.2 mm	IEC60521	°C	960

Industrial Shields can operate any change of the materials without being obliged to forewarn.



INDUSTRIAL SHIELDS

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