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MI907A

microstep precision amplifier
User manual

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INTRODUCTION

Our products are designed to operate reliably if they are installed and used according to the user manual.

Maintenance of the product should only be performed by Midi Engineering, except replacing the fuse (time-delay 4A).

- ✓ **Good practise of use and storage**
- ✓ Do not touch the product when it is powered.
- ✓ Do not unplug the motor when device is powered.
- ✓ Wait for the complete extinction of the LEDs before handling the device.
- ✓ Do not connect the motor when the power is powered
- ✓ Do not place the product on a position that is not stable:: the device may fall and cause injury or be damaged.
- ✓ Observe the ventilation specified in the user manual.
- ✓ Do not use or store the device in a humid.
- ✓ A priori, connect the frame ground of the product to the reference mass of the machine (ground) through pin 24C of connector J1 (see § frame ground for more details).
- ✓ Internal battery (if existing): **do not try** to recharge the battery, to disassemble, to plunge into the water or to get rid of by fire. Return the product to Midi engineering that will do the replacement and recycling of the battery.
- ✓ Never insert objects into the openings of the product.
- ✓ Making a careful wiring of the card.

Use shielded wire, twisted by pair, shield connected to ground for power and motor connections above 0.3 m.

Internal protections

This electronic device is equipped with components and protective systems intended to protect the product itself and the devices input -output which it is connected.

An input protection fuse protects against excessive upstream power consumption, possibly due to electronic device failure or of motor, that subject to sizing supply conductors are in accordance with the cutoff value of fuse specified in the documentation…

The other protection elements are:

- ✓ Protection against overvoltage by disjunction, due to a "crowbar circuit" and fuse 4 A.
- ✓ Protection against short circuit and connection faults motor by disjunction.
- ✓ Protection against overcurrent caused or suffered, by limitation of the current or disjunction
- ✓ Protection against undesirable heating of power components by disjunction

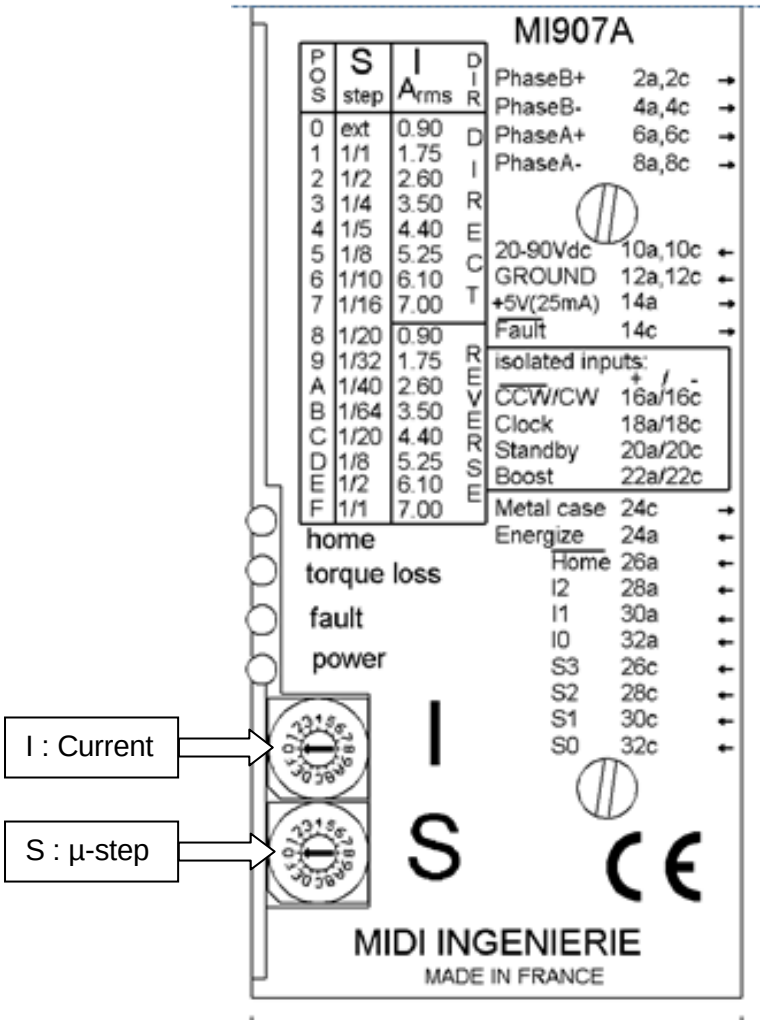
Elements of protection accessible to the user are présent:

- ✓ Input "reset" or stop emergency.

I - GENERAL DESCRIPTION

The device MI907A is a control amplifier switching for stepper 4 wires, 6 or 8 wires, working in bipolar mode.

It is used to control a stepper motor in micro-step mode with a resolution of 1-64 µ-steps /step, up to $7A_{RMS}$ and a supply voltage of 22-90 VDC.



Format 3U : 100 x 160 x 54
Connector : DIN 41612, 32 pins type D

Heat sink temperature ≤ 110°C
The MI907A is designed to be integrated into a chassis, the card is not isolated by an enclosure. This isolation is the responsibility of the integrator.

II - SPECIFICATIONS

Dimensions	Standard 3U x 8 TE	100 x 160 x 54 mm
Weight		650 g
Connector		DIN 41612, 32 pins type D
Power source DC	Voltage filtered DC stabilized	22 Vdc ↔ 90 V_{DC}
Protections	Thyristor Delay Fuse 5x20 Against short-circuit of a coil and between coils No protection against short circuits to ground	> 95 V_{DC} 4 A typical Melting 72 I2t Voltage rating 250ac Disjunction.
Motor-Stepper	Type Current Ieff. (adjustable by rotary dip switch or TTL inputs) Standby current (20a/20c) Boost current (mode overcurrent : 22a/22c)	Bipolar 4 wires or 8 wires From 0,9 A to 7A eff. by level of 0,88A eff. each 66 % of rated current 133 % of rated current (limited to 7 A_{eff})
Resolution of the µ-stepping	adjustable by rotary dip switch or TTL inputs (S0, S1, S2, S3)	1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64µsteps/step
frequency range	Maximum step rate Pulse width	500 kHz 1 µs
Input	Input TTL	3 for adjust the motor current 4 to set the resolution µ-step / step 1 for the power
	Opto-isolated inputs	4 (Ccw/Cw, Clock , Standby, Boost)
Output	Open collector	Fault Home
Operating Temperature		0 à 40°C with fan
Storage Temperature		-40°C à 85°C

III - FEATURES

✓ The four main input of the electronic device are opto-isolated:

- Clock,
- Ccw and Cw,
- Boost (overcurrent),
- Standby.

Galvanic isolation of inputs facilitates the integration of the card in an industrial environment.

✓ The others adjustment functions of the card can be set either by rotary dip switch or through the connector but are not electrically isolated:

- Current setting,
- Number of microsteps per step,
- Energized (opposite function = ”Torque off” if the pin 24a connected to the ground)

✓ State transitions of the clock signal must be less than 5µs and without noisy.

✓ When the inputs "Boost" and "Standby" are not active together, the power delivered to the motor is zero.

✓ The direction of rotation of stepper is a function both of the input opto-coupled "Ccw/Cw" but also the value of the rotary dip switch which adjusts the current.

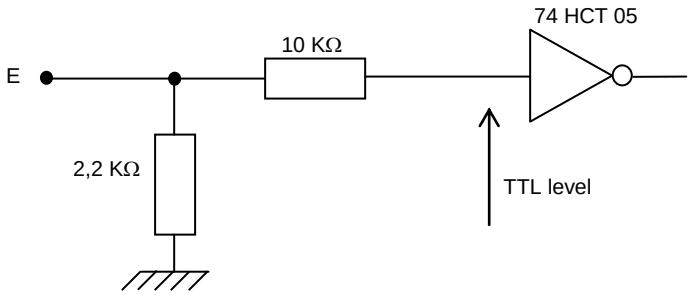
Input opto-coupled Ccw/Cw	Rotary Dip Switch for adjust the current	Results
Not activated Not activated	0 . . . . . 7 8 . . . . . F	Clockwise, Cw Counterclockwise, Ccw
Activated Activated	0 . . . . . 7 8 . . . . . F	Counterclockwise, Ccw Clockwise, Cw

- **TTL compatible inputs with pull-up resistor to the ground (2,2 KΩ)**

  Selection by connector inputs are active according to Chapter IV (if rotary dip switch = zero)

- Current setting (3 bits / I0, I1, I2)
- Selection of the number of µ-steps / step (4 Bits / S0,S1,S2,S3)

Be careful : the maximum voltage accepted is 24Vdc !

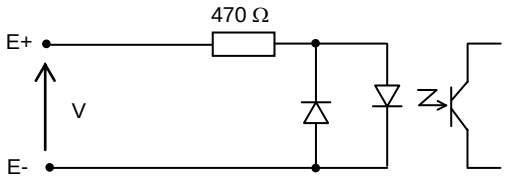


- **Opto-isolated inputs**

- Clock (active input on the falling edge: 1➔0)
- CCw and Cw*
- Boost (Overcurrent)*
- standby*

* These functions are active when the corresponding inputs are powered.

(I = 4 mA min) 5V < V < 8V
Two other possibilities :
Either: 7V < V < 15V need to use an additional resistor of 1 KΩ (serial),
Either: 15V < V < 30V need to use an additional resistor of 2,2 KΩ (serial).

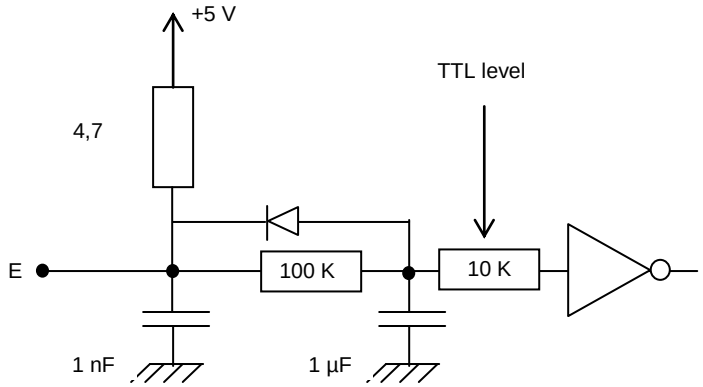


Be careful: Preset time of the input "Ccw/Cw" must be active at least 100 µs before clock edge!

- **TTL compatible input with pull-up to 5V (Energize only)**

The connection of the input "Energize" to the ground cuts the motor power and resets the device.

Be careful, this function must not be used as a "safe torque off".
The non-connection or connection to 5V level, makes active the motor supply.



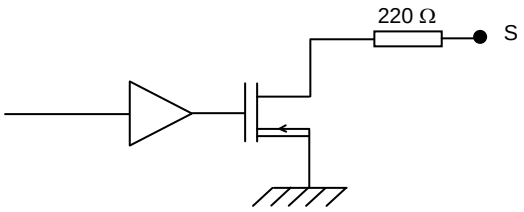
Note: The power of the motor is gradual, to avoid the overcurrent during the stabilization of the current loop (delay ≤ 2s).

- **Open collector outputs active at 0**

  - "Fault": it indicates a disjunction by overcurrent or thermal.
  It is reset by the input "Energize" or a powered on of the electronic device.

  - "Home": This output is active when the currents in the two motor coils are the same amplitude and positive (1 time by electric cycle or each of 4 mechanical cycles) .

  - The duration of the "0 pulse" is equal to the clock period.



- **Leds control.**

- Green led: Electric supply of electronic device is correct.
- Red led: Fault (disjunction by overcurrent or thermal,…)
- Yellow led: Torque loss.
- Green led: Home.

- **Mechanical ground**

The mechanical part of device MIP907A (heat sink, hood) are connected to the pins 24c (mechanical ground). This pin 24c is connected through a filter RC to the electronic ground of the board. It is not necessary to connect this 24c to the machine ground if the electric ground is already connected to machine ground. In order to avoid some problems with ground loops..

IV - SETTING CURRENT

Rotary dip switch	I_2	I_1	I_0 *	I_{RMS} A	Ccw / Cw Input not-active
0	0	0	0	0,90	Clockwise, Cw Facing the motor shaft
1	0	0	1	1,75	
2	0	1	0	2,60	
3	0	1	1	3,50	
4	1	0	0	4,40	
5	1	0	1	5,25	
6	1	1	0	6,10	
7	1	1	1	7,00	
8	0	0	0	0,90	Counterclockwise, Ccw Facing the motor shaft
9	0	0	1	1,75	
A	0	1	0	2,60	
B	0	1	1	3,50	
C	1	0	0	4,40	
D	1	0	1	5,25	
E	1	1	0	6,10	
F	1	1	1	7,00	

Note : Be careful to the movement stops, the current in one phase can reach $\sqrt{2}$ x Ieff in one of motor coil.

V – CHOICE OF THE NUMBER OF MICROSTEPS

Rotary dip switch	S_3	S_2	S_1	S_0 *	Number de µ-steps
0	0	0	0	0	3 external Inputs
1	0	0	0	1	1
2	0	0	1	0	2
3	0	0	1	1	4
4	0	1	0	0	5
5	0	1	0	1	8
6	0	1	1	0	10
7	0	1	1	1	16
8	1	0	0	0	20
9	1	0	0	1	32
A	1	0	1	0	40
B	1	0	1	1	64
C	1	1	0	0	20
D	1	1	0	1	8
E	1	1	1	0	2
F	1	1	1	1	1

* To use the commands from the connector, placing the rotary dip switch corresponding to position 0.

VI - CONNECTOR DIN 41612 TYPE D

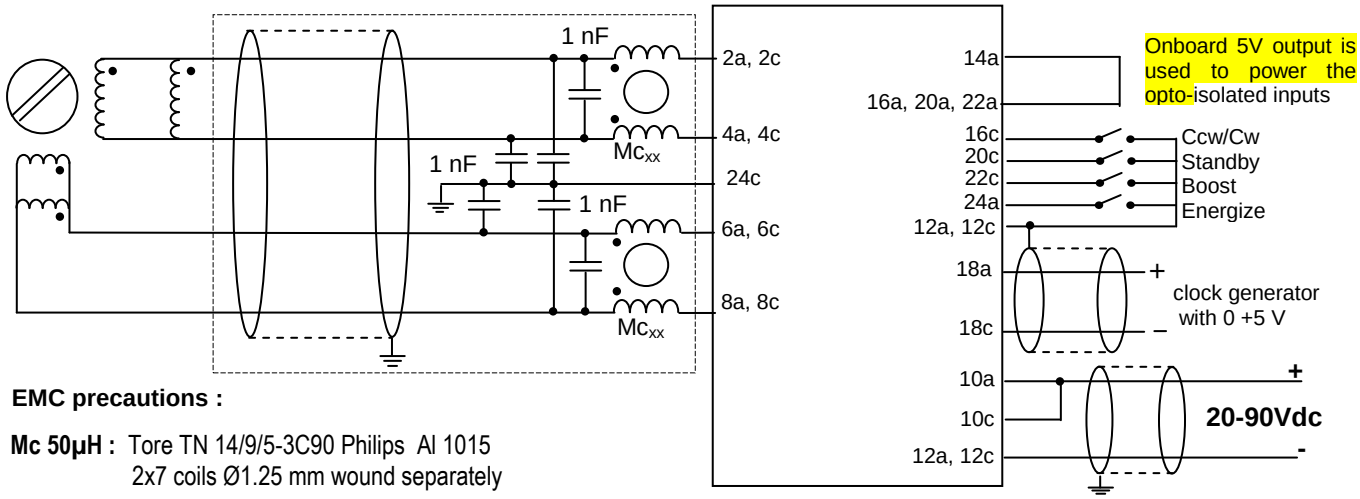
	c	a	
* Phase B+	2	2	Phase B+ *
* Phase B-	4	4	Phase B- *
* Phase A+	6	6	Phase A+ *
* Phase A-	8	8	Phase A- *
* 20-90Vdc	10	10	20-90Vdc *
* Ground	12	12	Ground *
Fault	14	14	+ 5V/25mA (Output)
Cw	16	16	Ccw
Clock -	18	18	Clock +
Standby -	20	20	Standby +
Boost -(Overcurrent)	22	22	Boost +(Overcurrent)
Chassis ground	24	24	Energize
S3	26	26	Home
S2	28	28	I2
S1	30	30	I1
S0	32	32	I0

Be careful ! Regarding the pin N° 14a, it is a voltage output 5V/25 mA made for polarization of the opto-isolated inputs. Don't connect with any external power.

* The pins "a" and "c" of the same number (2-12) are connected by pair in the device. However, it is advisable to use two pins available especially with high current.

VII - CONNECTION

Example with stepper with 8 wires, coils in parallel and with polarization of opto-isolated inputs by onboard 5V.



EMC precautions :

Mc 50µH : Tore TN 14/9/5-3C90 Philips AI 1015
2x7 coils Ø1.25 mm wound separately

or

Mc 550µH : Tore TN 23/14/7-3C25 Philips AI 3800
2x12 coils Ø2.25 mm wound separately

and

polyester capacitor 1nF/400V MKT 370

In an environment disturbed electrically and concerning wiring distances greater than a few tens of centimeters, it is advisable to shield the clock connections by using shielded twisted pairs with the shield connected to the mass of the device. (12a 12c), also don't connect the shield on generator side.

Electromagnetic compatibility : Taking into account switching mode of the device, in addition to the usual installation precautions (shield, ground...), using of a common mode Filter **(2x Mc$_{xx}$ + 2x Capa. 1nF + 4x Capa. Motor/Ground 1nF**) connected to the stepper phases can facilitate compliance with the requirements of EMC emission of the system, especially when the engine is far away from the control board. A shielded cable connection is recommended with wires twisted by pair.

Details of connections