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ARP

HARDWARE Manual **Ver. 1.21**





1. Description

ARP is a completely programmable control to regulate the tension with the measurement of the load cells and the position control on two axes. It independently operates and manages the machine cycle.

The system can have two configurations:

- **ARP** Solution : panel mounting with an eventual remote management control on can-bus
- **ARP/T** Solution : wall mounting with a TR5 built-in operator terminal; this solution can be supplied (on demand) with a RS232 serial port to connect a printer.

The ARP unit must be supported by a user's program, developed and tested through the WinAxis application program (provided with the unit) and a PC connected to the RS232 serial line. WinAxis allows to build the program with its internal editor, to compile it generating the executable file, to transfer it in the permanent memory of the ARP unit through the RS232 serial line and to start the test session, shown in a pertinent window, displaying all data of the application program.

The ARP running program acts with variables, flags, inputs and outputs to completely manage the resources connected to the system; moreover, it is also possible to set complex mathematical expressions, with brackets, to carry out the calculations suitable for the application.

User's program resources:

- 1000 permanent variables (32 bit words) - 6.3 integer format (ex. 999999.999).
- 256 volatile bit flags (8 word x 32 bit each).
- 6 timers with time reading and automatic flags management.
- 6 electric cams for automatic managing of digital outputs.
- 6 functions interrupting the main program
- Symbolic identifiers for variables, digital I/O
- Program organization instructions: goto, call, if.

Bit instructions (input, output, flag):

- Digital I/O reading and writing
- Value assignment: set, res.
- Logical functions: and, or, xor, not.
- Electric cam (outputs management according to the encoder position).

Variables instructions:

- Value assignment: ==, +=, -=, *=, /=.
- Logical and arithmetical operations: +, -, *, /, and, or xor.
- Trigonometric operations: sen(x), cos(x).
- More: square root, integer part, module, left shift, right shift.



Analog I/O instructions:

- Reading of the input from load cells.
- Reading of the analog input / writing of the analog output

Movement instructions:

- Action in engineering units (mm, degrees, etc.).
- Maximal speed and acceleration setting.
- Absolute and relative positioning.
- Table-defined master-slave electronic gearing, with automatic continual variation in position and speed among different portions.
- Immediate stop of an axis in a controlled ramp according to the set deceleration.

Regulation instructions:

- PID regulation function with feedback from the load cell or from an analog input, in particular addressed to applications on linear tension regulators or on winding and unwinding machines.

Operator interface management instructions:

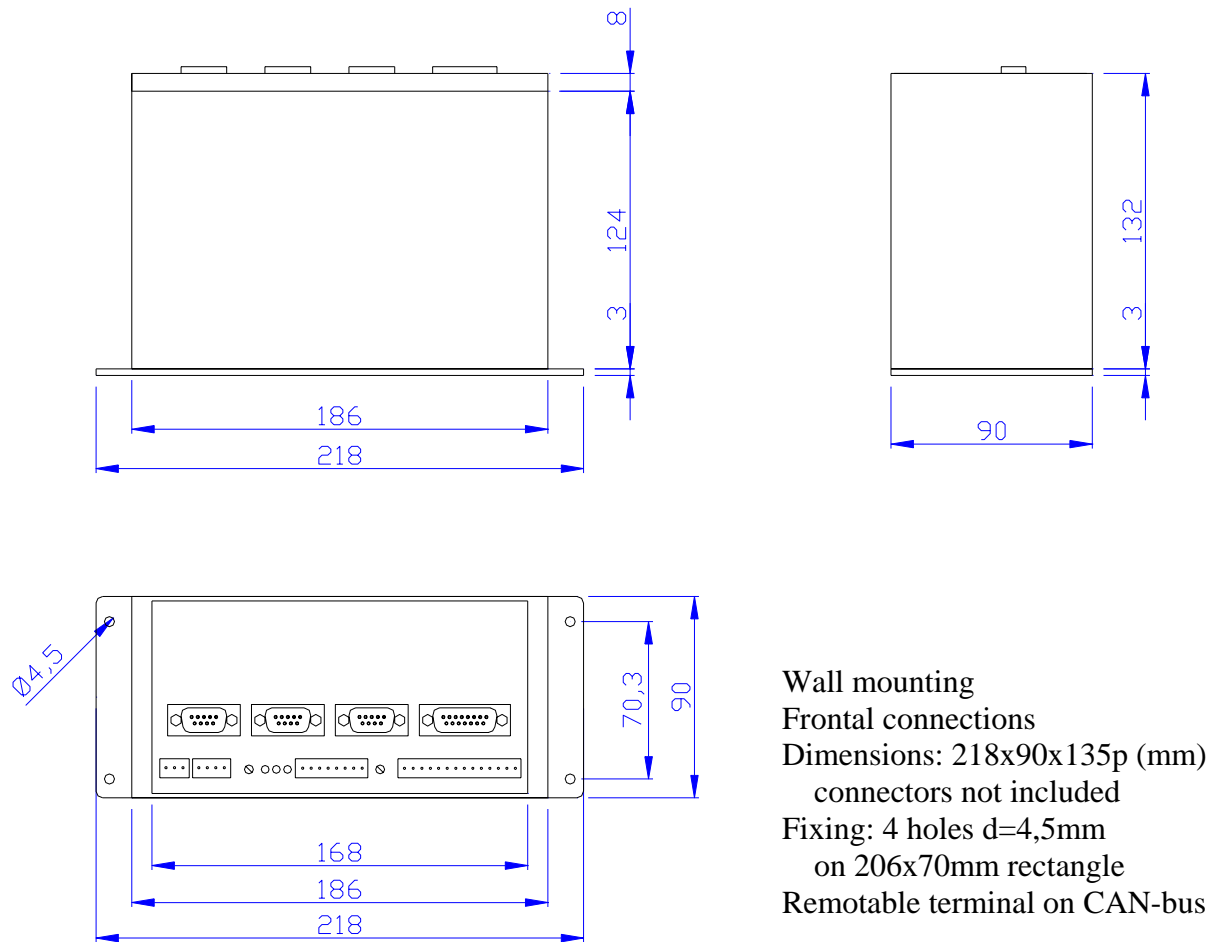
- Messages recording on the operator panel.
- Messages displaying on the operator panel.
- Messages printing on the auxiliary serial port of the TR5 operator panel.

2. Technical Characteristics



Picture 1 – ARP-T Keyboard

- Main processor: DSP 16 bit @ 40 MHz with 64 KB flash on-chip memory.
- 16 KB not-volatile RAM memory for parameters, user's program and permanent variables.
- RS232 serial interface for diagnostics and programming.
- CAN interface for I/O expansions.
- n. 2 interfaces for each load cell with:
 - completely independent sense wires
 - 24bit converter
 - bridges power supply: total 5Vcc/60mA for all load cells
 - programmable sampling frequency
- n. 2 analog inputs $\pm 10V$, 16 bit resolution (they could also be 4-20mA)
- n. 2 analog inputs 10V, 10 bit resolution
- n. 2 analog outputs $\pm 10V$ (one of them could be 4-20mA)
- n. 2 RS422 5V interfaces for incremental encoder, channel A and B
- n. 8 digital inputs 24Vcc (positive logic)
- n. 4 digital outputs 24Vcc/0,1A (positive logic)
- External power supply 24Vcc $\pm 10\%$.
- Opto-isolated external interfaces
- Aluminium case for panel or wall mounting
- Optional membrane keyboard with 25 keys and 16 x 8 digits display (**ARP/T** version)



Wall mounting
 Frontal connections
 Dimensions: 218x90x135p (mm)
 connectors not included
 Fixing: 4 holes $d=4,5$ mm
 on 206x70mm rectangle
 Removable terminal on CAN-bus

Picture 2 – Mechanical dimensions for the version without terminal

3. Installation and diagnostics

3.1. Safety instructions

In order to have an installation under safety conditions, it is necessary to follow, besides the existing regulations, some simple rules:



- All metallic parts of the plant must be connected to earth.
- Control the external devices related to safety before effecting the plant working process check.
- Test and maintenance of the plant must always be carried out by qualified staff.
- Before starting the system, be sure that it isn't in danger conditions for people and things and for the functioning of the machine itself.
- Before changing any parameter, check the correctness of the parameter itself and value which could be the real effect of this change.

3.2. Instructions for the electromagnetic compatibility

The electromagnetic interferences (EMI) can cause the bad functioning of this or other devices located nearby, compromising the plant working. Therefore, it is necessary, during the installation, to take all precautions to limit the above mentioned interferences produced by parts constituting the plant itself.

A correct connection of all devices to earth reduces the problems caused by EMI; in particular, it is important to follow carefully the regulations indicated in the here-under paragraphs.

3.2.1. Connections to earth

- Connect to earth all metallic parts of the units composing the plant.
- Avoid serial connections to earth; connect each unit to the main earth.
- The main earth bar must be connected to the metallic cabinet and to the general ground manhole.

3.3. Cables shielding

All cables for “D” connectors on ARP must be copper shielded. It is possible, even if not recommended, especially for very long cables, to join all conductors of different connectors in a single shield, respecting the uniformity of the tension and current levels and the signal kinds.

If joints on shielded conductors are required, it will be necessary to limit the not twisted and not shielded cable length, joining the cable in the farthest point as possible from electrical interferences, such as motors, drivers, etc.

Alternatively, it is possible to place the joint inside a metallic box, which can be: connected to earth, but isolated from the shield connections of the two joined cables, or connected to the shield of the joined cables, isolated from earth.

The best configuration for the shielding functioning is to connect both ends of the cable to the protective covering of the two devices. In order to avoid the shield having currents circulation which could make it useless or even a noising source, the shield itself should not be used as an earth interconnection between the two devices and the equipotentiality of the two masses must be assured by special conveniently sized connections.

The connections of 24V power supply can be realized with unshielded cables.

4. Interfaces



Picture 3 – Connectors position

4.1. Configuration DIP-SWITCH

The card has two groups of dip-switches: the first one is used to manage the Can-Bus port, the second one is used to update the firmware of the main processor.

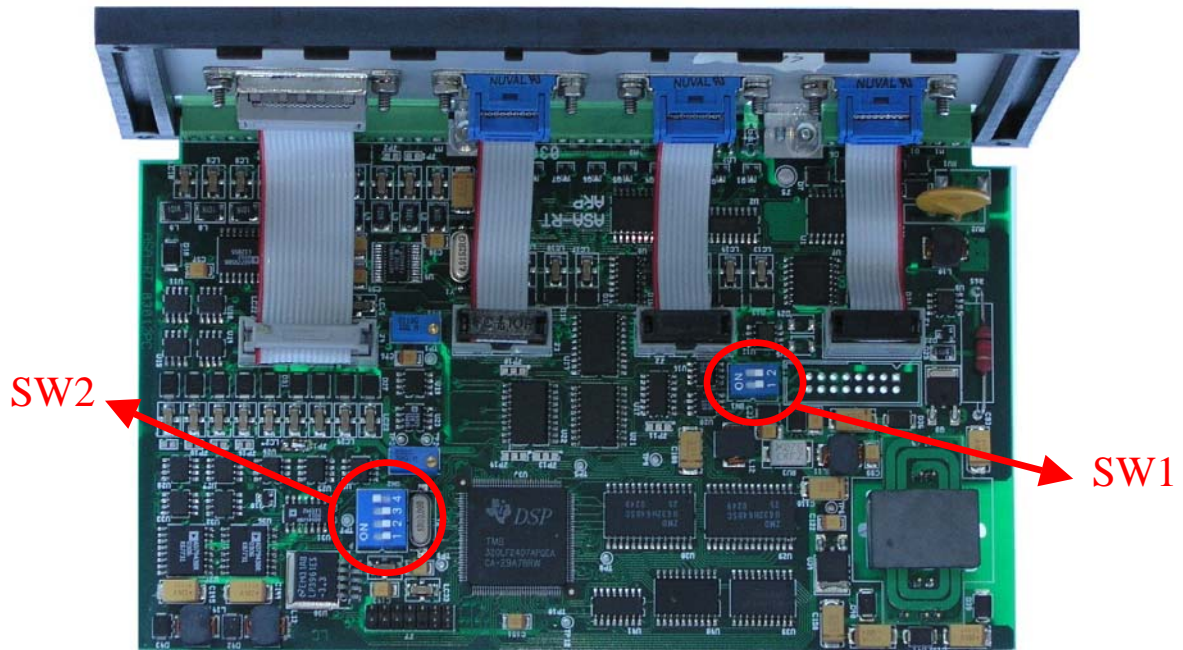
	ON	OFF
SW 1.1	Not used	
SW 1.2	120Ω resistance as termination on CAN BUS	No termination on CAN BUS

Table 1 – SW1 dip-switches

	ON	OFF
SW 2.1	Not used	
SW 2.2	Firmware Download	Standard Functioning
SW 2.3	Firmware Download	Standard Functioning
SW 2.4	Firmware Download	Standard Functioning

Table 2 – SW2 dip-switches

NOTE: all dip-switches SW2 must always be in OFF position in order to allow the standard system functioning.



Picture 4 – Dip-switches position on the card

4.2. Status led

On the connectors panel of the ARP unit there are two status led, called “A” and “B”.

The “A” led indicates the error condition of the unit:

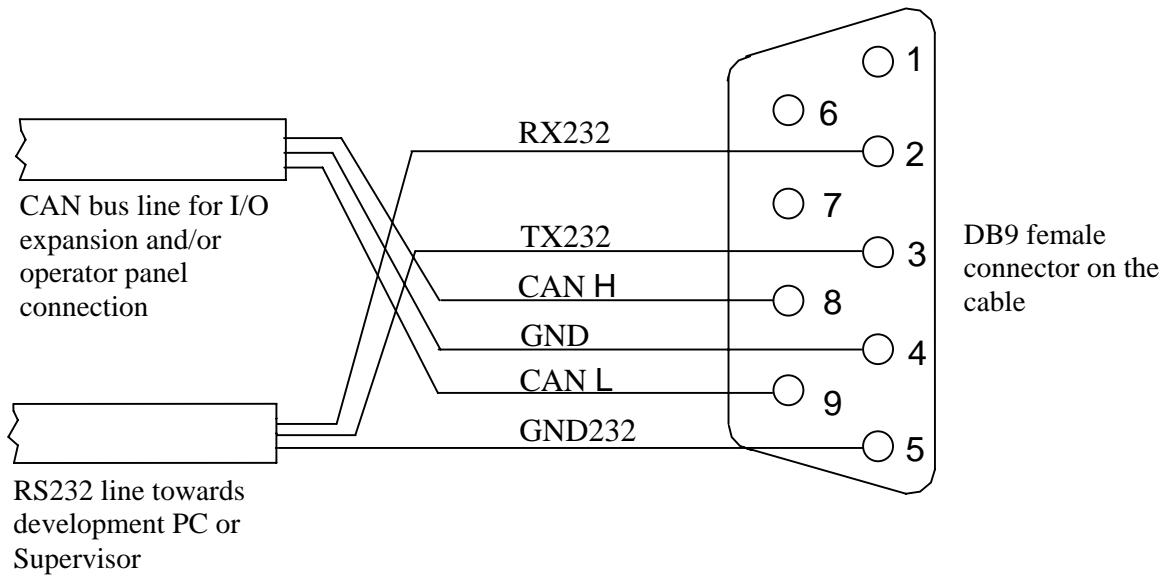
- Green ⇒ No errors, No warnings
- Yellow ⇒ No-stopping warnings
- Red ⇒ Stopping error

The “B” led indicates the user’s program status

- Green ⇒ Run program
- Red ⇒ Stop program

The correct functioning of the unit is indicated by the two green-lightened led.

4.3. J1 Connector – Can Bus / RS232



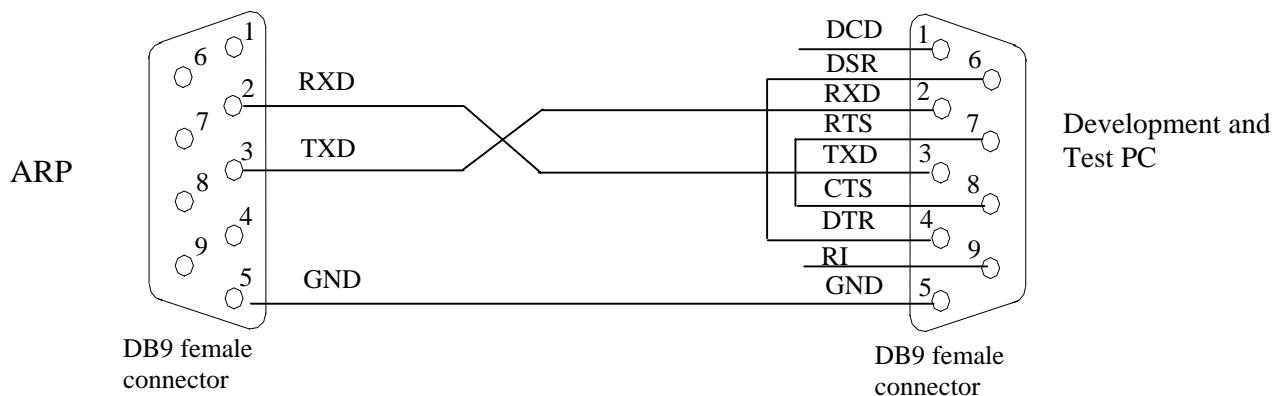
Picture 5 – Can Bus / RS232 Connector

The card has a RS232 / Can Bus serial communication port; in this way it is possible to connect:

- a development PC through a binary protocol, to load and test the application program loaded on the card itself
- a machine supervisor through a binary protocol
- I/O CANOpen DS-301 expansion modules
- an operator panel compatible with CANOpen

The serial interface is supplied according to the standard EIA RS232 and it allows a short-distance communication (up to 15 meters) between two devices.

The here-under diagram indicates the cable connections between the ARP system and a PC with the standard serial port; this cable can be supplied by ASA-RT on require.

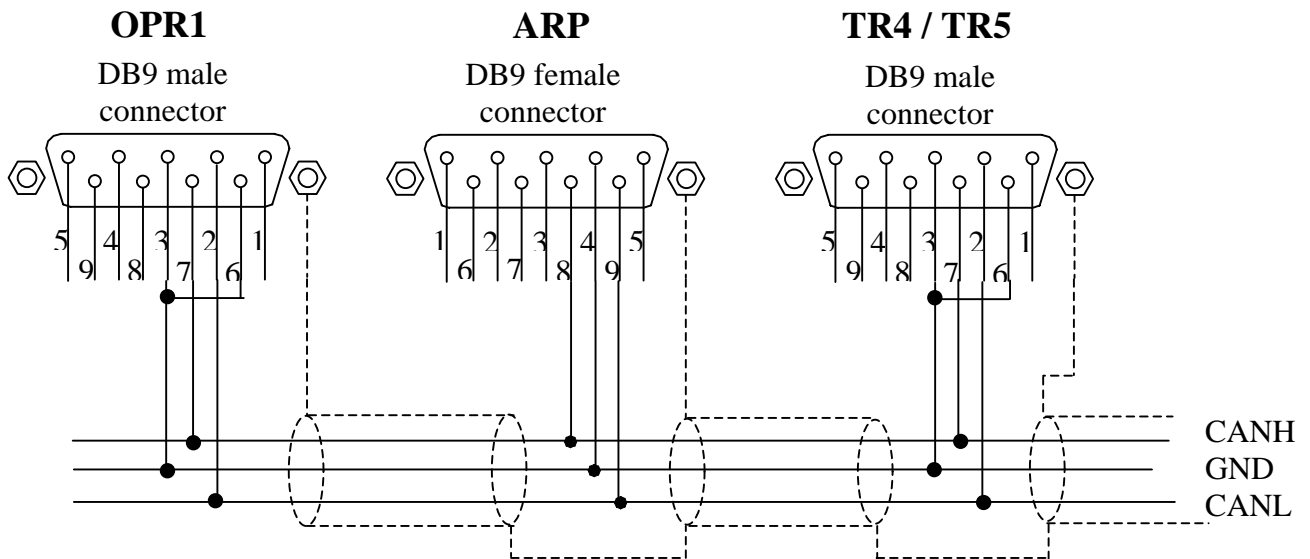


Picture 6 – RS232 Connection

When a connection between two MASTER-SLAVE units through CAN BUS is carried out, it is indispensable to connect two termination resistors to both side. If there are more than two devices, it will be necessary to remove all terminations from the intermediate devices, keeping the ones at the two ends of the line.

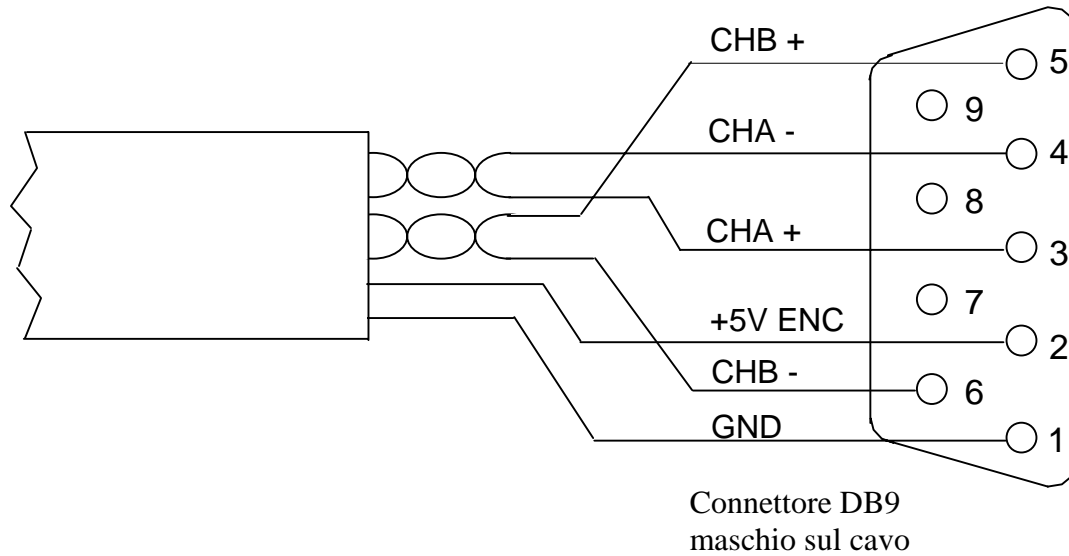
To set the ARP node identifier, refer to the software manual.

In the here-under picture it is shown the typical correct example of connection of several devices through the CAN BUS line. In order to reduce interferences, it is recommended to follow this diagram.



Picture 7 – Connection of several devices through can bus

4.4. J2 and J3 connectors – Encoder

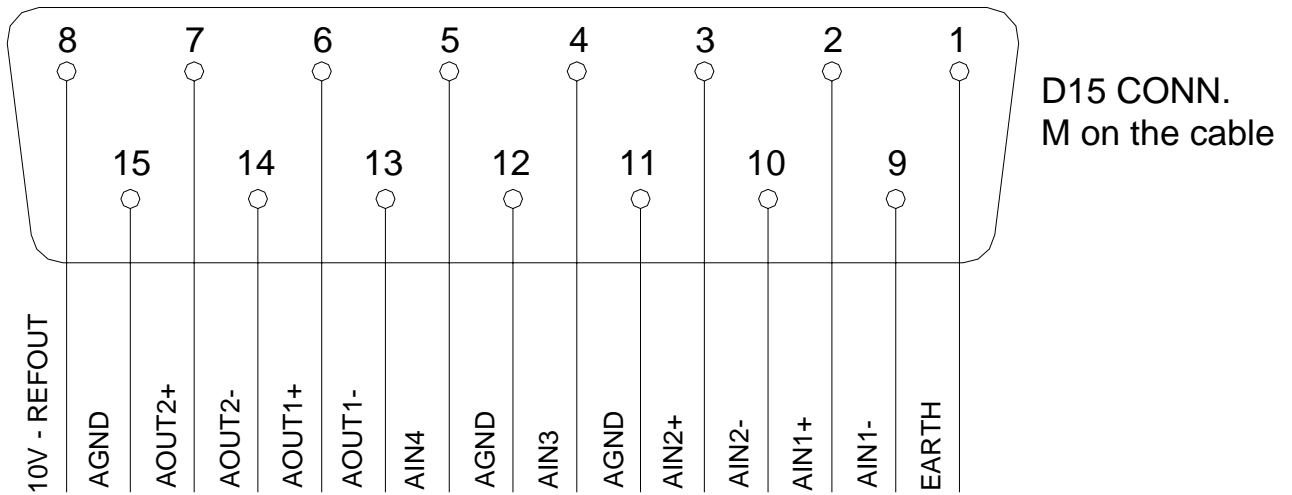


Picture 8 – Incremental encoder connection

The unit has two encoder inputs with a 5V LINEDRIVER electrical interface, compatible with the RS422 standard communication line (5V differential), with field multiplier (x 4).

4.5. J4 Connector – Analog I/O

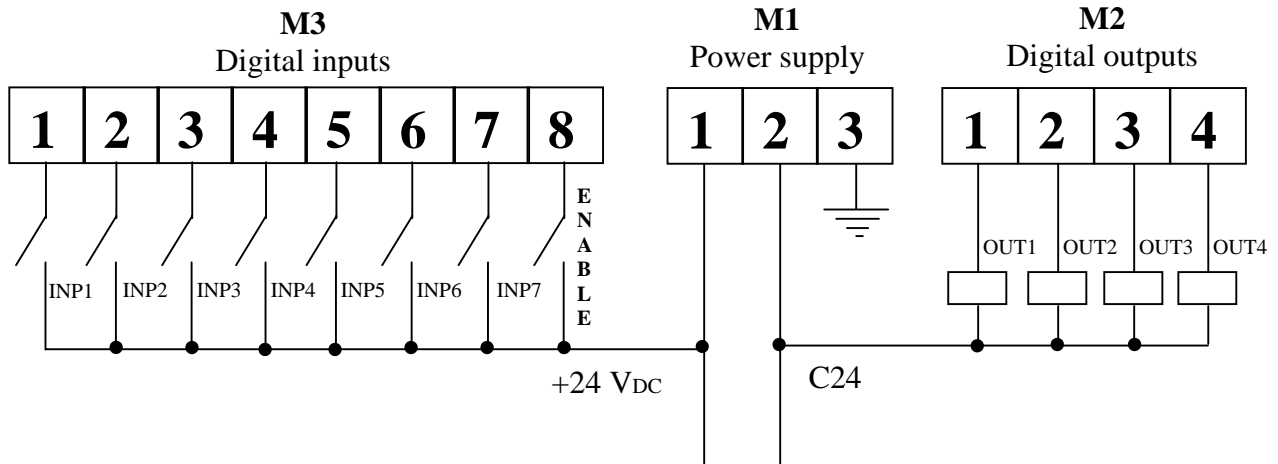
J4 - ANALOG I/O



Picture 9 – Analog I/O connection

	PIN	
EARTH	1	Shield
AIN1-	9	Differential #1 analog input ±10V or 4-20mA (completely pre-defined)
AIN1+	2	
AIN2-	10	Differential #2 analog input ±10V or 4-20mA (completely pre-defined)
AIN2+	3	
AGND	11	Differential #3 analog input
AIN3	4	0 ÷ 10V
AGND	12	Differential #4 analog input
AIN4	5	0 ÷ 10V
AOUT1-	13	Differential #1 analog output ±10V or 4-20mA (completely pre-defined)
AOUT1+	6	
AOUT2-	14	Differential #2 analog output ±10V
AOUT2+	7	
AGND	15	Power supply for external potentiometer
REFOUT	8	+10V / 20mA

4.6. M1, M2, M3 junction boxes– Power supply and digital I/O



Picture 10 – Power supply and digital I/O

External power supply : +24 V_{DC} ± 10 %

Digital outputs electrical features:

- **Output residual current at “0” level** : max 20 μA
- **Drop-out tension at “1” level** : 1.5V max @ 1.5A
- **Maximal current for each output** : 0.25A.
- **Protections** : polarity inversion

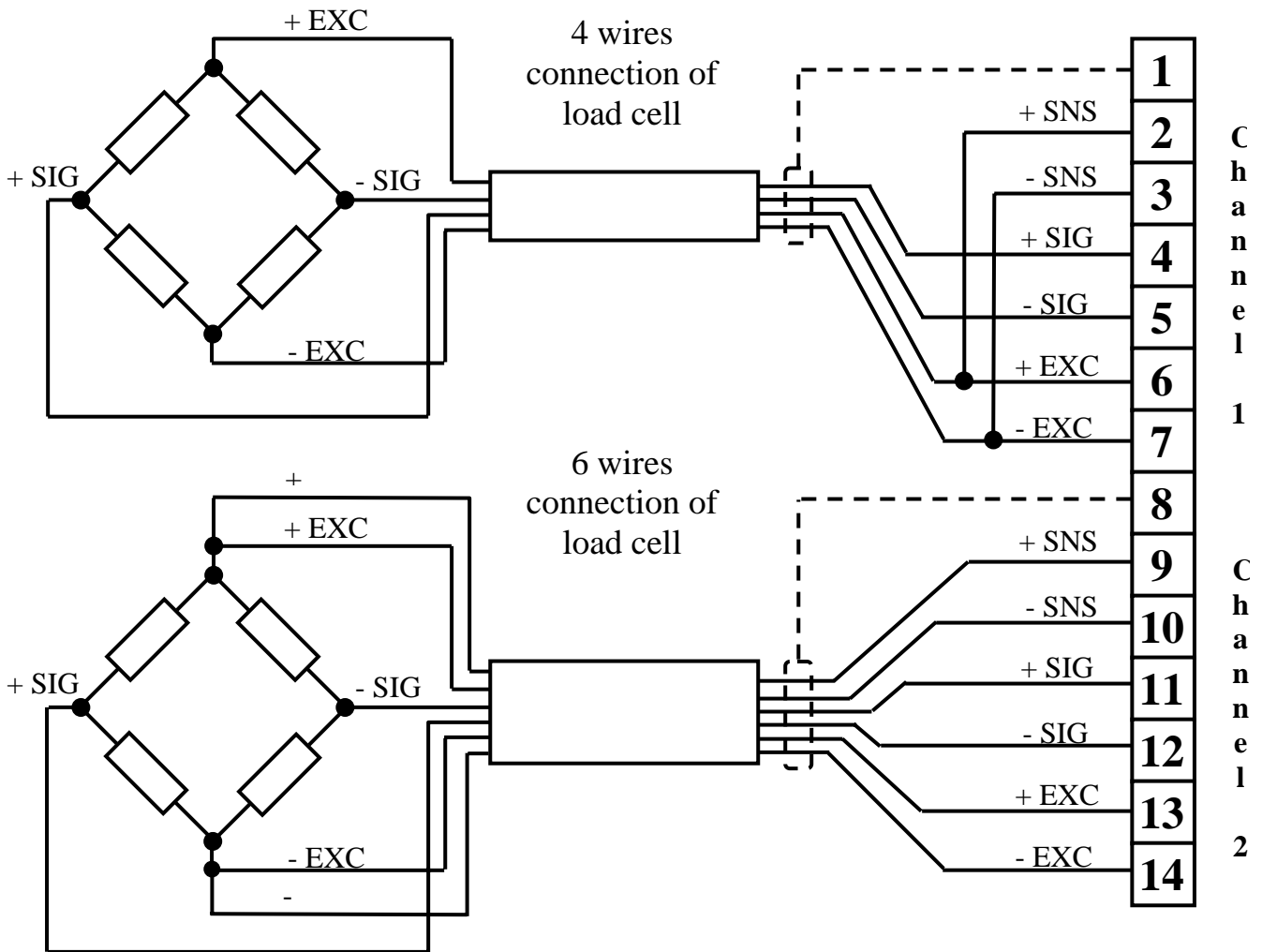
Digital inputs electrical features:

The ARP digital inputs characteristics are according to CEI EN 61131-2 rules

	“0” Status	Transition	“1” Status
Input tension	-10 ... 5 V	5 ... 15 V	15 ... 28 V
Current	0 mA		2,5 - 5 mA

Activation time: < 4ms. for standard inputs

4.7. M4 Junction box – Amplified inputs for load cells



Picture 11 – Load cell connection diagram

In the previous diagram it is shown the connection of the strain gages bridges with four and six wires. It is possible to carry out the independent regulation on the two inputs channels. In this case, if two or three load cells are used as measurement source, it will be necessary to wire all sensors on the same input channel.





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