# AL-1232 4 ISOL. ANALOG. OUT, 12 BITS, 4-20mA/-10+10V

Revision: A

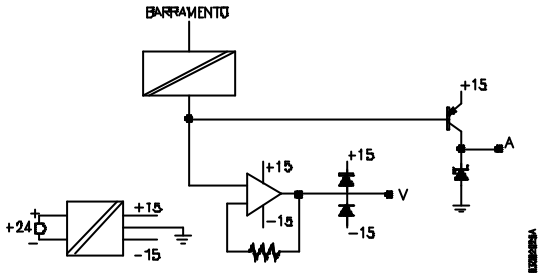
Doc code.: 6110-572.4

## 1. Product Description

The analog output module AL-1232 is intended for 12 bits digital-to-analog conversion of application program memory values. The conversion can be performed either in current or in voltage in each one of the four output channels. The outputs are isolated against the system up to 2,500Vdc.

This TC is valid from the revision A of the AL-1232 module.

The simplified circuit for one current/voltage output is shown below:




## 2. Packing List

The product is composed by:

- AL-1232 - 4 isolated analog output, 12 BITS, 4-20mA/-10+10V
- Installation guide

## 3. Functional Characteristics

### 3.1. General Characteristics

- Number of points per module: 4
- Analog GND common to all points
- Data representation in the application program: decimal base. For example, 12mA through an output means 1,000 units in the application program
- Allowed load types: resistive and capacitive.
- Protection features: against short circuit and voltages up to 30Vdc in the output.
- Connection to the process by screwed terminal
- Connection cables diameter: 0.5 to 1.5mm$^2$
- SCAN LED indicating that the CPU has accessed the module
- Isolation provided by optocouplers
- MTBF: 25.810 horas @ 40°C
  calculated according MIL-HDBK-217E
- Operating temperature: 0 to 60°C
  exceeds IEC 1131 standard
- Stocking temperature: -25 to 75°C
  according to IEC 1131
- Operating humidity: 5 to 95% non-condensing
  according to IEC 1131 level RH2
- Weight:
  net: 450 g
  packed: 595 g
- Environmental protection: coating
- Protection level: IP 30, against unintentional introduction of tools, no water protection.
  according to IEC Pub. 144 (1963)

### 3.2. Electrical Characteristics

- Output signal range:
  voltage mode: -10 to +10 V
  current mode: 4 to 20 mA
- Load over the operating range:
  voltage mode: 1 kΩ minimum
  current mode: 600 Ω maximal
- Maximum calibration error:
  voltage mode: ±1 LSB
  current mode: ±1 LSB
- Maximum error @ 25 °C:
  voltage mode: ±2 LSB
  current mode: ±3 LSB
- Maximum power dissipation:
  10 W
- Temperature coefficient:
  voltage mode: ± 100 ppm/°C
  current mode: ± 180 ppm/°C
- Maximal error over temperature range:
  ± 0.5% end of scale
- Resolution:
  11 bits + signal
- LSB value:
  voltage mode: 5 mV
  current mode: 8 µA
- Delay time[1]:
  1.0 ms
- Thermal stability time:
  5 min
- Non-linearity:
  voltage mode: ±1 LSB
  current mode ±1.5 LSB
- Repeatability:
  0.007% end of scale
- Monotone output without overshoot
- Maximal capacitive load (voltage mode):
  90 nF
- Isolation voltage between the outputs and the system or between the outputs and the 24Vdc power supply
  2,500 Vdc
- Maximum external voltage applied between the output point and its reference
  voltage mode: ±30 Vdc
  current mode: +30 to –0.6 Vdc
- Short circuit protection between outputs
- Short circuit current
  ± 30 mA (voltage mode)
- External power supply:
  nominal: 24 Vdc
  tolerance: 19.2 to 30 Vdc (ripple included)
- Power consumption:
  20 mA @ 12 Vdc from bus
  350 mA @ 24 Vdc from external power supply
- Electrostatic Surge Discharge (ESD):
  according to IEC 1131, level 4
- Oscillatory wave noise immunity
  according to IEC 1131, level C, and IEEE C37.90.1 (SWC)
- Fast transient (BURST) noise immunity:
  according to IEC 1131 level B
  according to IEC 801-4, level 3

1. Time spent by the module to convert the digital values to analog and update the output after the PLC has transferred the values. This time does not consider the PLCs cycle time.

- Irradiated electrical field immunity:
  10V/m @ 140 MHz
  based on IEC 1131
- Applied voltage test:
  1.500 Vrms between outputs and power supply input
  1.500 Vrms between outputs and system/earth
  1.500 Vrms between power supply input and system/earth
  according to IEC 255-5

## 3.3. Software Characteristics

The AL-1232 module has a microcontroller with serial port used for adjust.

If the application program from programmable controller stops to access the module, the output value remain the same.

If the CPU fails, all the current outputs are blocked (0mA) and the voltage outputs remain in 0V.

Value ranges:

Current mode

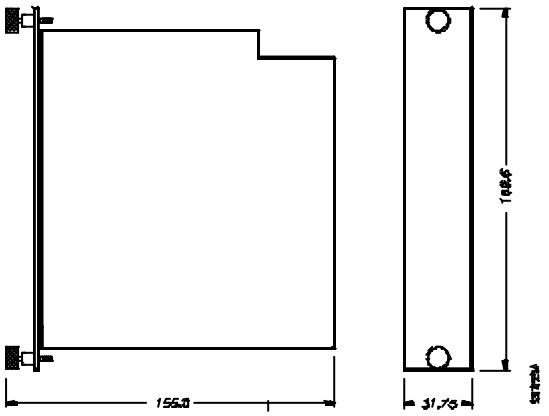
| Digital Value | Analog Value |
|---|---|
| 0 | 4.000 mA |
| 2,000 | 20.000 mA |

Voltage Mode

| Digital value | Analog value |
|---|---|
| 0 | -10.000 V |
| 4,000 | 10.000 V |

The operation mode (voltage or current) may be set by the application program, allowing the module to use one output in voltage mode and another output in current mode (only one mode is allowed per canal). See the programmer's manual handbook (D/A instruction) to get more information.

# 4. Physical Dimensions




# 5. Installation

The proper installation of the module must be considered in order to ensure the correct functionality according to the information in this document.

The installation consists in:

- configure the address of the module (see the PLC's user's manual handbook)
- put the module in the rack, in a suitable position according to the electrical project.
- plug the connector from the CPU's cable in the module
- connect the power supply at the module, ensuring that the polarity is correct and that the power supply is not overcharged
- connect the field cables, taking care about noise, by keeping it far from noise potential sources.

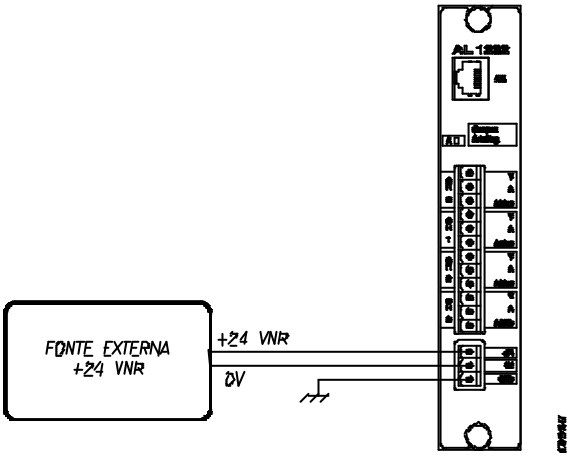
## 5.1. Connecting the External Power Supply

The module must be powered by an external power supply, for example, the AL-1518 power supply, which must be connected at the points identified with +24 and 0V (the 0V point may be grounded or not). The power supply features must be the following:

- Nominal voltage: 24 Vdc
- Tolerance: 19.2 to 30 Vdc (ripple included)
- Current capacity: 350 mA (per powered module)

The point identified as GND is reserved to the ground connection of power supply.

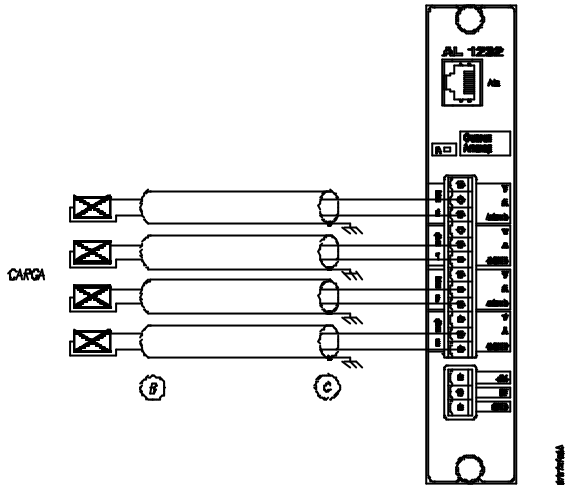
The connection diagram with the external power supply is shown below:




Once powered, the scan LED will turn on for about 1 s, meaning the microcontroller on the module is working correctly.

## 5.2. Direct Connection to the Load

The following picture shows the load connected directly to the current output through a shielded cable in terminal block points A and AGND.



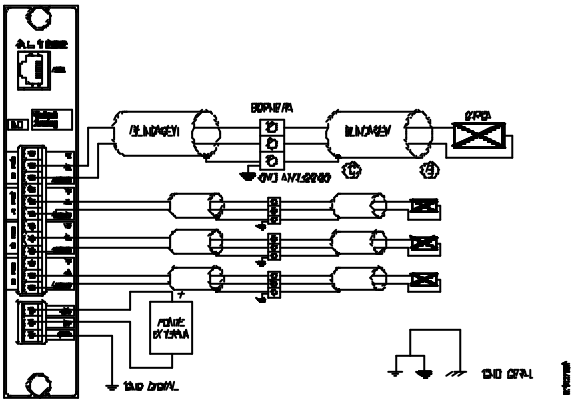

To connect a voltage output, the points V and AGND must be used.

The shield connection with the ground must be done at the point C

If it is not possible due to the transducer used, make it shielding at the B point.

## 5.3. Connection through a Terminal Block

The following picture explains how to use a terminal block to connect field cables to the module:



The shield connection is the same mentioned in the previous item.

The digital ground and the analog ground must be connected in only one point, that is the main ground of the system.

## 5.4. Cable Lengths

■ Voltage mode:

The maximum length of the shielded cable to be used in the voltage output (loss not greater than 5mV, full load):

5.0 m for cables with resistance of 96 Ω/km
8.5 m for cables with resistance of 57 Ω /km

The method to calculate the maximal cable length is shown below:

**$L_{máx}$(m) = 500 * (load (kΩ) / resistance per km (Ω))**

■ Current mode:

Maximal length of the shielded cable to a current output (allowing a connection of two instruments of 250 Ω in series):

1.5 km for cables with resistance of 57 Ω/km
1.0 km for cables with resistance of 96 Ω/km

## 5.5. Straps

There are two configurable straps in this module: PA3 and PA4.

The strap PA3 has the function to configure the module address in the system. To find more information about how to address the I/O modules, see the PLC's user's manual handbook.

The strap PA4 is not used and must remain open.

# 6. Handbooks

For more information about installation and use of the I/O modules, see also the PLC Utilization Handbook.

For more information about programming see the Programmer Utilization Handbook.

## 7. Revisions

The revision of this document is shown at the right upper corner, indicating changes.

ALTUS reserves the rights to change this document without previous notice.

The following historic shows changes to each revision:

| | |
|---|---|
| Revision: A | Date: 09/06/99 |
| Approval: Luís Fernando Alvim Saraiva | |
| Author: Alexandre Hessler - AP&D | |

Remarks:

- Inicial revision