reset

measuring amplifier for strain gauges

ADS-R

CE

installation and diagnostic instructions

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introduction

Dear customer,

Thank you for the preference given to this product which we are sure it will satisfy you with its solutions, the design and the quality of construction.
The ADS-R is a digital measuring amplifier for strain gauges bride, including a 24 bit acquisition circuit with programmable gain, 3 analog outputs towards a supervision unit and two digital inputs for the zeroing from a remote supervisor.

It is possible to add to this basic configuration the following functionalities:

• A fieldbus interface (Profilbus DP, Profilnet I/O, CANopen, ModBus RTU)
• A second acquisition circuit, with relative analog outputs and digital inputs. This makes the unit (ADS-R2) a system with two completely independent measuring channels, plus a third channel that reports the average value of the other two; on each of these three channels it is possible to execute a specific calibration.
• Up to four digital outputs for threshold alarms.

From a functionality point of view, three different modes are now set:

• A basic mode, in which the measuring amplifier allows the analog signal zeroing (calibration), and the output gain increasing / decreasing, by a three keys interface; the output tension is continuosly visualized on the display, allowing, therefore, the adjustment without external instruments (tester or screw-driver).
• An advanced mode compatible with the past (selectable with the keys " + " and " - ") where, using just the three keys " **+** " , " **-** " and " **0/↵** " and the display, it's possible to program in sequence the main parameters of the unit: zero, gain, bandwidth of the signal, etc; at the end of the parametrization the display shows the measure corrected according to the set parameters.
• An advanced mode with mnemonic menu (selectable with the key "**Prg**") where, using the five keys and the display, it's possible to program in sequence all the parameters of the unit: zero, gain, bandwidth of the signal, etc; at the end of the parametrization the display shows the measure corrected according to the set parameters.

warning

CAREFULLY READ THE INSTRUCTIONS AND WARNINGS IN THIS MANUAL AND KEEP THEM FOR FURTHER REFERENCE FOR THE ENTIRE PRODUCT LIFE. THEY GIVE YOU IMPORTANT INSTRUCTIONS REGARDING OPERATIONS AND SAFETY RULES FOR INSTALLING, USING AND MAINTAINING THE PRODUCT IN THE CORRECT WAY.

PLEASE TAKE THE TIME TO READ AND FULLY UNDERSTAND THE INSTRUCTIONS BEFORE THE INSTALLATION AND THE USE OF THIS PRODUCT.

IN CASE OF A POSSIBLE BREAKDOWN OF THE PRODUCT, THE OPERATOR SHOULD UNDERSTAND THE MANUFACTURER'S INSTRUCTIONS AND BE AWARE OF THE DANGERS, BEFORE ANY CHECK INTERVENTION OR RECOURSE OF RENOVA'S TECHNICAL ASSISTANCE.

assistance

Renova is worldwide present with Agents and Distributors.

Contact Renova support
support@renova-srl.it

safety instructions

In order to have an installation in safety conditions, it is necessary to follow, besides the existing regulations, some simple rules:
•Metallic parts of the plant must be connected to the ground.
• Control the external devices related to safety before start up the plant.
• Tests and maintenance of the plant must always be performed by qualified staff.
• Before starting up the system, make sure that it does not lead to dangerous situation for people, stuff and for the machine itself.
• Before changing any parameter, check the rightness of the parameters and evaluate which could be the real effect of those values.

instructions for the electromagnetic compatibilty

The electromagnetic noises (EMI) can cause the bad functioning of ADS-R or of other devices located nearby, compromising the plant performance. Therefore, it is necessary, during the installation, to take all precautions to limit the above mentioned noises generated by parts the plant is made of.
A correct wiring of all devices to the ground reduces the problems caused by EMI; in particular it is important to carefully follow the regulations indicated in the here-under paragraphs.

installation

Connections to the ground:
Connect to the ground all the metallic parts of the unit constituting the plant. Avoid serial connections to the ground, but connect individually each unit to the main ground.
The main ground bar must be connected to the metallic cabinet and to the general ground.

Mounting:
The ADS-R unit is to be assembled on vertical wall onto a DIN guide
Do not locate the unit near sources of heat
Space out the units at least of 10 mm.

Wires shielding:
The wires corresponding to the analog signals must be shielded. To avoid the shield having current circulation, which could make it useless or even a noising source, the equipotentiality of the ground connections of the plant-cabinet system must be assured by special connections, conveniently sized. If the equipotentiality is assured, the best configuration for the shield is to have it connected to both the ends of the load cell - measuring amplifier system.
If the equipotentiality is not assured, it is advisable to connect the shield only to the measuring amplifier side. The connection of the digital IO and 24 V power supply can be performed with unshielded cables.

installation and diagnostic instructions

TECHNICAL CHARACTERISTICS

The main technical characteristics of the unit are:

- External power supply 24 VDC ± 20%
- N. 1 Interface for strain gauges bridge, characterized by:
    - Bridge supply 5 VDC
    - 60 mA total (4 load cells 350 Ohm in parallel)
    - Acquisition with a 24 bit ADC converter.
    - Indipendent sense wires.

- N. 2 analog outputs ± 10 VDC
- N. 1 analog output 4...20mA
- N. 2 opto-isolated input digital signals 24 VDC (positive logic)
- 5 digits display indicating the output value in V (from +9,999 to –9,999)
- Zeroing analog key (calibration)
- Analog gain increasing/decreasing keys
- Program/Esc key
- Digital/Channel selection key
- Assembling on Din guide with step 22,5 mm, 35 mm, or 45 mm
- Operative temperature 0°C ÷ +50°C
- RS 485 optional connection (ASCII protocol)
- Profibus DP v1 optional connection
- Profinet I / O optional connection

When present, the acquisition expansion card adds the following:

- N. 1 Interface for strain gauges bridge, characterized by :
    - Bridge supply 5 VDC
    - 60 mA total (4 load cells 350 Ohm in parallel)
    - Acquisitionwith a 24 bit ADC converter
    - Indipendent sense wires

- N. 2 Analog outputs ± 10 VDC
- N. 1 Analog output 4...20 mA
- N. 2 Opto-isolated input digital signal 24 VDC (positive logic)

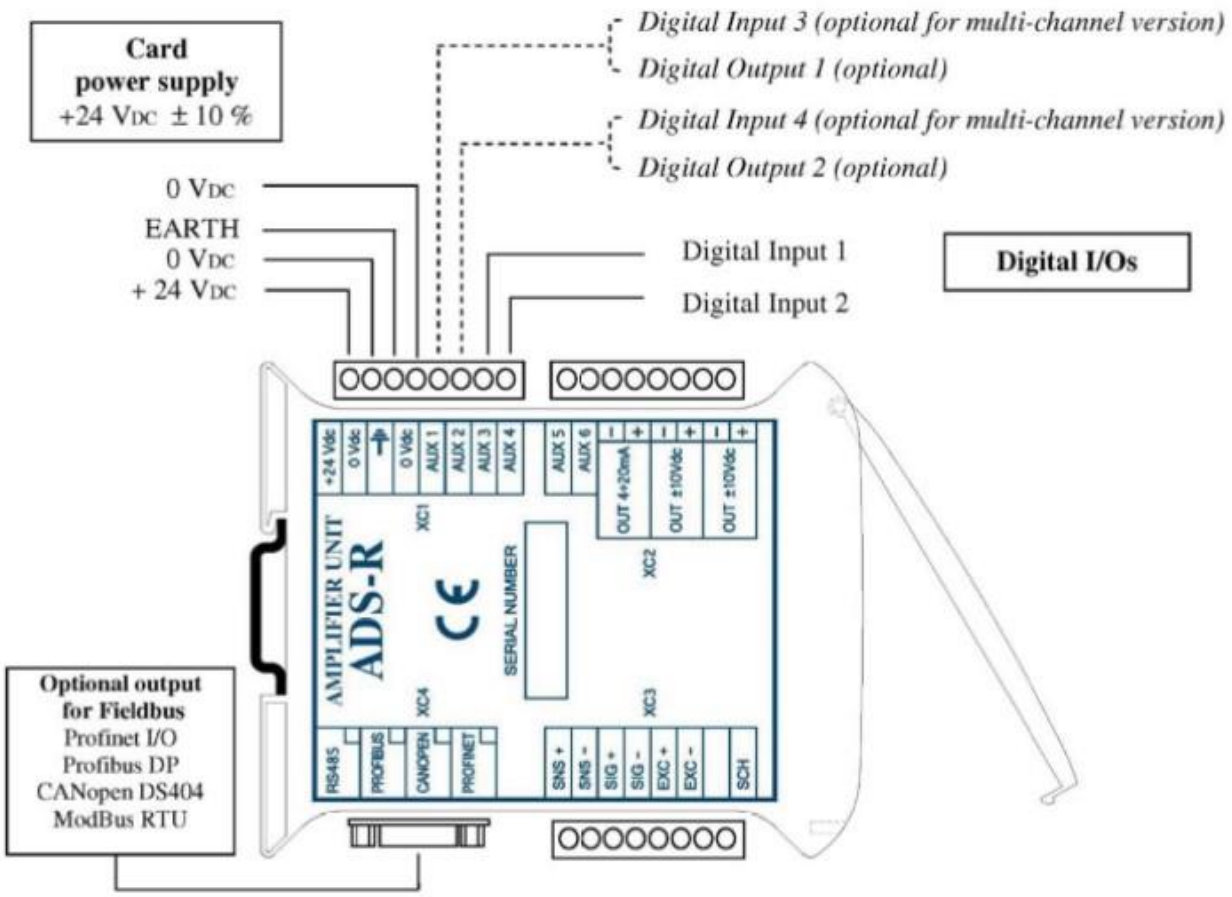
When present, the digital outputs expansion card adds the following:

- N. 4 opto-isolated output digital signal 24 VDC / 0,02 A (positive logic)

electrical connection

CONNECTOR XC1

Power supply of the card and digital I / Os



Digital inputs characteristics:

	State “0”	Transition	State “ 1 “
Input Voltage	-30 …. 5V	5 …. 15 V	15 …. 30 V
Current	< 1 mA		2-6,5 mA

Digital outputs characteristics:

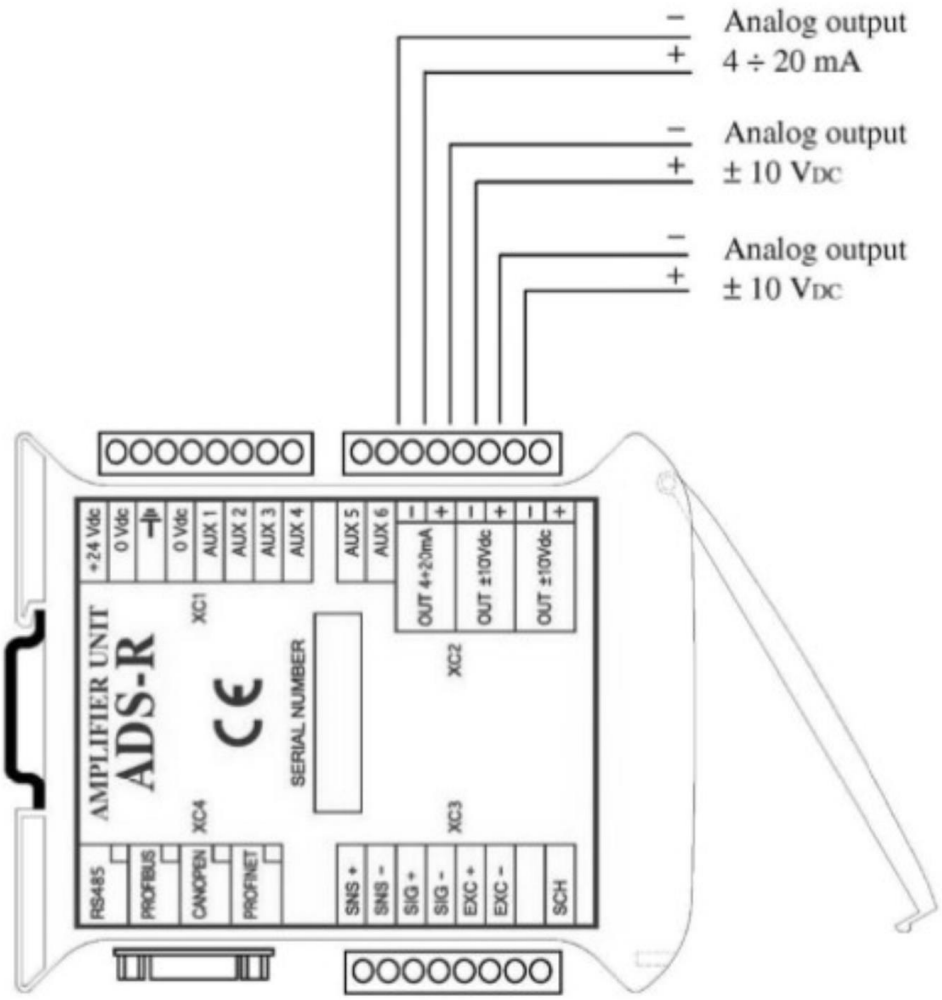
level “0” residual output current	< 20 µA
level “1” drop-out tension	1 V max @ 50 mA (two outputs with maximum current at the same time)
maximum current for each single output	50 mA
protections	ESD , recirculation of inductive loads

Warning : When the Profinet expansion card is present, the I/Os are not working.

CONNECTOR XC2

I / O analog outputs

The ADS-R unit has two tension analog outputs and one current analog output, all of them indicating the amplified value of measurement. In standard working mode the three analog outputs indicate the amplified value of the strain gauges bridges.



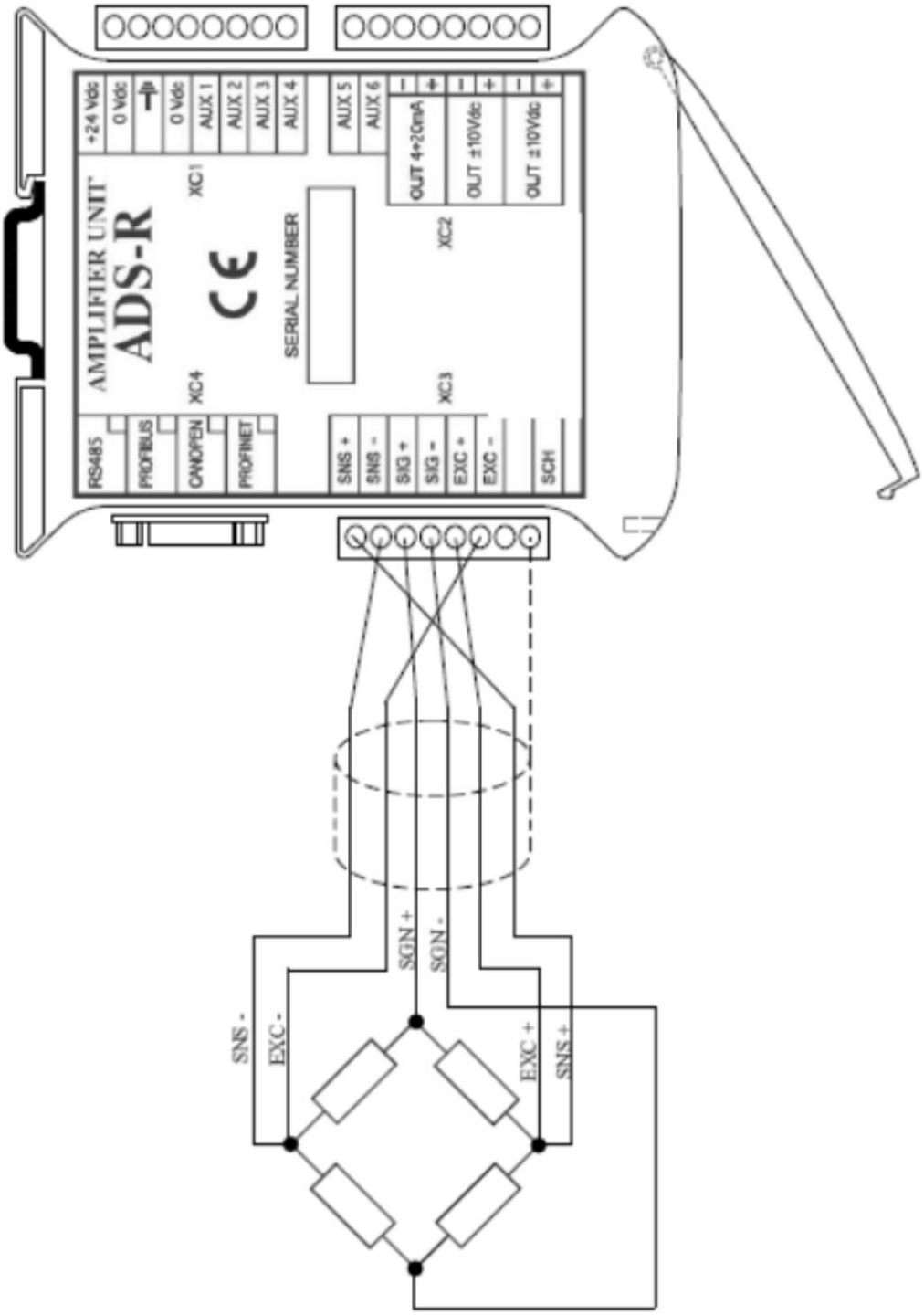
Electrical specification for the analog outputs:

Maximal tension on the analog current output	4 VDC (200 Ohm)
Maximum consumption on the analog voltage output	5 mA

In the multichannel version of the ADS-R, the connector XC2 is also present on the expansion card for the second acquisition channel.

CONNECTOR XC3

Load cell input
It is here-under reported the wiring scheme among load cells and the ADS-R unit.

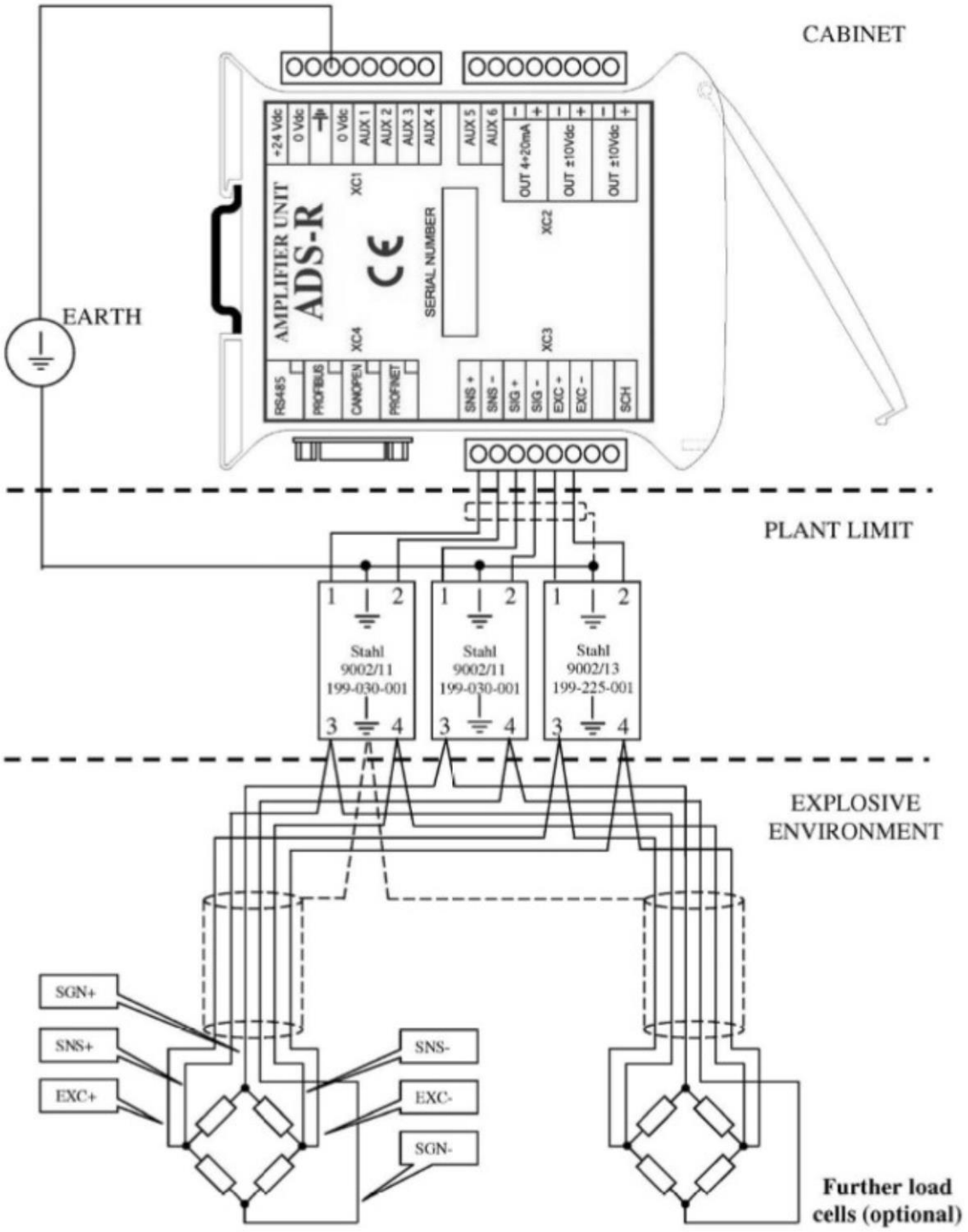


The unit can work with load cells connected with 4 or 6 wires and it is able to support up the 4 load cells in parallel connection.

In the multi-channel version of the ADS-R, the connector XC3 is also present on the expansion card for the second acquisition channel.

Explosive environment

• In potentially explosive environment, it is necessary to insert zener safety barriers on the signal of the load cell, as indicated in the here-under diagram (example with the employment of Stahl safety barrier).



operative mode

GENERALITY

The ADS-R has an HMI interface made by 5 push bottom and a 5-digit display.
When the device is activated, the display shows for few seconds the text " ADS-R " and then the software version of the unit. At this point the unit is in the normal working mode, ready to run.

In the normal working mode in the five digit of the display it is shown the actual measure, already corrected according to the value of the parameters set in the unit; with the set of factory parameters supplied with the unit the value shown corresponds also to the tension in Volt on the analog outputs.
Read the display from top to bottom.
If the displayed value blinks, it means that the measured value to be displayed, evaluated according to the current parameters, is out of the full-scale range of ± 10.000.
If this condition happens, it is possible that the calibration of the gain has to be reconsidered.
If "_ _ _ _ _ " is displayed, it means that the input value is higher than the calibration of the maximal value set for the input range. In this case, it's necessary to modify the parameter "**Range**", setting an higher value.

The measuring amplifier must be switched on when the load cells are already connected in order to avoid to change the calibration result.

In the multi-channel version, the ADS-R handles two completely independent measuring channels, plus a third channel that returns the average value of the other two; on each of these three channels it's possible to perform a specific calibration.

SETTING A VALUE

The unit ADS-R has two different types of data that can modified by the user:

Data that can be set only on pre-defined values: in this case the possible values can be scanned using the " + " and " - " keys.
Data that can be set on a defined range of values: in this case with the keys " **+** " and " **-** " it is possible to scan the actual digit, while for changing it, the key " **Sel** " has to be used.

Once a value has been defined, it must be confirmed pressing for at least three seconds the key " **0 / ↲** ". If the data is valid, the unit shows the text "**STORE** " and saves it in its memory; otherwise the unit shows the text " **ABORT** " and maintains the old value.

DATA PROTECTED BY PASSWORD

If the system is protected with a password, when the user tries to modify a value, the unit show the message " Ins P " for a second; at this point it is possible to insert the password value. To confirm it, press the key " **0 / ↲** " for few seconds.

SELECTION OF THE CURRENT CHANNEL

In the multichannel version of the unit, it is possible to select the current channel on which we operate by pressing the key " **Sel** ".
Every time the key " **Sel** " is pressed, the unit changes cyclically the next acquisition channel and shows shortly the current channel number.

ZEROING OF THE UNIT

This procedure is to be performed in the zero condition of the system (no load on the load cells except for the assembling load and tare.
The zeroing of the unit is obtained by pressing the button " **0 / ↲** " for at least three seconds. If a password has been set to protect the parameters, before doing the zeroing of the unit, the user is requested to digit it (see chapter above).
The zeroing can also be performed by a remote supervision unit generating a rising edge on the digital input 1 (or the digital input 3 for the second acquisition channel in the multichannel version). This procedure zeroes both the displayed value and the analog outputs of the currently selected acquisition channel.

INCREASE / DECREASE OF THE AMPLIFICATION GAIN

The increase / decrease of the amplification gain is obtained by pressing the button "**+** " or the button " **-** " for at least 3 seconds. The value displayed will be updated in real time, considering the change of the above-mentioned gain, allowing an immediate check of the result.
If a password has been set to protect the parameters, before changing the gain of the unit the user is requested to digit it (see advanced functioning).
This procedure acts both on the displayed value, and proportionally on the analogue outputs of the currently selected acquisition channel.

ERROR CODE

The ADS-R unit can return the following error codes in case of fault or wrong parametrization

Err01	Faulty, or not correctly initialized, load cell acquisition circuit
Err02	Reserved
Err03	Reserved
Err04	Reserved
Err05	Reserved
Err06	Init error for the Profibus DP expansion card
Err07	Init error for the Profibus DP expansion card
Err08	Init error for the Profibus DP expansion card
Err09	Init error for the Profibus DP expansion card
Err10	Init error for the Profibus DP expansion card

Errors from 6 to 10 can also appear if it's set in the parameter **ESPCd** an expansion card phisically not present on the unit.

ACCESSING THE PARAMETERS

The ADS-R unit has a set of configuration parameters for adapting its behavior to the user's needs. For accessing to these parameters, it is necessary to proceed as follows:

• Press the key "**Prg**" for few seconds
• If the system is protected with a password the unit shows the message " **Ins P** " for a second.
• Then it shows zero on the display. At this point it is possible to insert the password value and confirm it by pressing the key " **0 /** ↲ ".
• In the parameterization mode on the display, the set of general parameters or a set of channel parameters are shown; by pressing the key " **Sel** " it is possible to move from a set to another one.
• On the display a mnemonic related to the parameter currently selected is shown; the parameters of the current channel can be scanned by the keys " **+** " and " **-** ", and displayed by the key " **0 /** ↲ " .
• To modify the value of a parameter it is necessary to act on the keys " **+** " and " **-** " ; for the parameters with an high range it is possible to select the digit to be modified by acting on the key " **Sel** ".
• To save a new value on a parameter it is necessary to press the key " **0 /** ↲ " for few seconds; the unit will display "**Store**" and will save the new value. If the value is out of the acceptable limits the unit will display "**Abort** " and no modification will be made.
• For exiting from a modification / visualization of a parameter it is necessary to press the key "**Prg** "; a second press of the key "**Prg** " for few seconds turns the unit back to the normal working mode.

GENERAL PARAMETERS

The unit has a set of general parameters for setting the communication data and other general characteristics.

Pass	**Password** Protection password for editing the parameters (if set to 0 no password protection)	(0 ÷ 9999) Default = 0
Node	**Node identifier on the bus** Node identifier for the unit on the Profibus link	(1 ÷ 127) Default = 14
FBaud	**Fieldbus baud-rate** Working baud-rate on the fieldbus link (acquired in automatic)	Automatic
SBaud	**Serial baud-rate** Working baud-rate on the RS232 or RS485 serial link	(96—192—384) Default = 96
SProt	**Protocol type on the serial link** Protocol type on the RS232 o RS 485 serial link	(ASCII o Modbus RTU) Default = ASCII
SDelay	**Replay delay on the serial link** Delay of the replay on the RS232 o RS485 serial link	(non actually used) Default = AUTO
ESPCd	**Expansion card present on the unit** Expansion card assembled on the unit; this parameter, if set wrongly , can generate error code	none , prbus , prnet Default = none

CHANNEL PARAMETERS

The unit has a set of parameters for acquisition channels; once selected the current channel with the key " **Sel** " , the accessible parameters will be the ones of the specified channel.

Range	**ADC acquisition range** Acquisition range of the AD converter, expressed in µV/V	(970—1950—3900) Default 1950
Filt	**Number of averages on the measure** Number of sample of the load cells signal used in the moving average window in order to increase the stability in the amplified signal.	(1 ÷ 250) Default = 10
Tare	**Offset for " tare " compensation** Offset for zeroing the reading in the " tare "condition. This parameter is also automatically set when a function of tare recovery is activated.	(-9999 ÷ 9999) Default = 0
Calib	**Sample weight for setting the gain** Sample value related to the current reading makes the AD converter. This parameter is a write-only one, while when read is shown to zero. The calibration with sample weight can only be performed on positive signal; in case of negative signal it is necessary to invert the polarity of the signal acting on the parameter " Inpol ". Setting this parameter, a new value is calculated for the parameter " Sens "; if this value is in the acceptable range, the calibration is stored.	Read only
Sens	**Sensitivity value for setting the gain** Value of the input signal expressed in µV/V, for having the measured value at its maximum value 9999.	(100 ÷ 9000) Default = 1000
Inpol	**Inversion of polarity** Enables / disables the inversion of polarity of the AD converter	(Dis ÷ Ena) Default = Dis
FS Uo	**Measurement value related to the full scale of the voltage analog output** Displayed measurement value that must corresponds to the analog output full scale (10VDC); afterwards, the output will proportionally change from zero to full scale with a measure from zero to this parameter.	(1 ÷ 9999) Default = 9999
FS Io	**Measurement value related to the full scale of the current analog output** Displayed measurement value that must corresponds to the analog output full scale (20mA); afterwards, the output will proportionally change from zero to full scale with a measure from zero to this parameter.	(1 ÷ 9999) Default = 9999
DecPT	**Position of the decimal point on the display** Digit after which the decimal point on the display is located. This point has only an aesthetic purpose and it must not be counted in the setting of the sample measure.	(0 ÷ 3) Default = 3

CALIBRATION OF THE GAIN

In order to perform a calibration of the system, load cells and measuring amplifier and to obtain a value displayed according to a scale which is useful for the user, it is possible to act in one of the following ways:

1. Calibration of the load cells with a sample known weight

• run the procedure for zeroing.
• apply the sample weight on the load cells
• set, on parameter " **Calib** " the value to be displayed in this situation (the value of parameter " **Sens** " will be automatically changed)

From now on, the system will process the measure, displaying the value set in correspondence of the sample weight, and will proportionally scale all the measures.

i.e.:

Calib = 600 (@ 60 Kg)	→	**Display** 600 @ 60 Kg	→	**Voltage output** 2,4 VDC @ 60 Kg	→	**Current output** 7,84 mA @ 60 Kg
FS Uo FS Io	→	**Display** 2500 @ 250 Kg	→	**Voltage output** 10 VDC @ 250 Kg	→	**Current output** 20 mA @ 250 Kg

1. Setting of a sensitivity value of the load cells

•Run the zeroing procedure
• Set on parameter " **Sens** " the sensitivity of the load cells or of the load cells system

In this case, the system will re-set the gains in order to obtain the reading " 9999 " when the system is loaded at the nominal load.
If it is necessary to have a number inferior to " 9999 " when the system is loaded at the nominal load, the sensitivity value must be incremented proportionally to the wished reduction.
Anyway, small further gain adjustments can be done acting on the keys " **+** " and " **-** " when display shows the measure.

i.e.:
Sensibility of the load cell = 1,236 mV/V @ 75 KG

Sens = 1236 FS Uo = 9999 FS Io = 9999	→	**Display** 9999 @ 75 Kg	→	**Voltage output** 2,4 VCC @ 60 Kg	→	**Current output** 7,84 mA @ 60 Kg
Sens = 1236 FS Uo = 9999 FS Io = 9999	→	**Display** 4000 @ 75 Kg	→	**Voltage output** 14 VCC @ 75 Kg	→	**Current output** 10,4 mA @ 75 Kg

FILTER ON MEASURE

The ADS-R unit acquires the values with a sampling rate of approximately 120 Hz. On these values it is possible to apply a moving window average in order to reduce the noise on the measure. The number of samples for this average is to be set on parameter " **Filt** ". With the value " 1 " the result of the average is the instantaneous value; with higher values the result will be proportionally smoothed.

i.e.:

Filt = 50	→	The last 50 samples are used for evaluating an average value of the measure. When a further value is available the previous 50 is deleted and a new average value is evaluated.

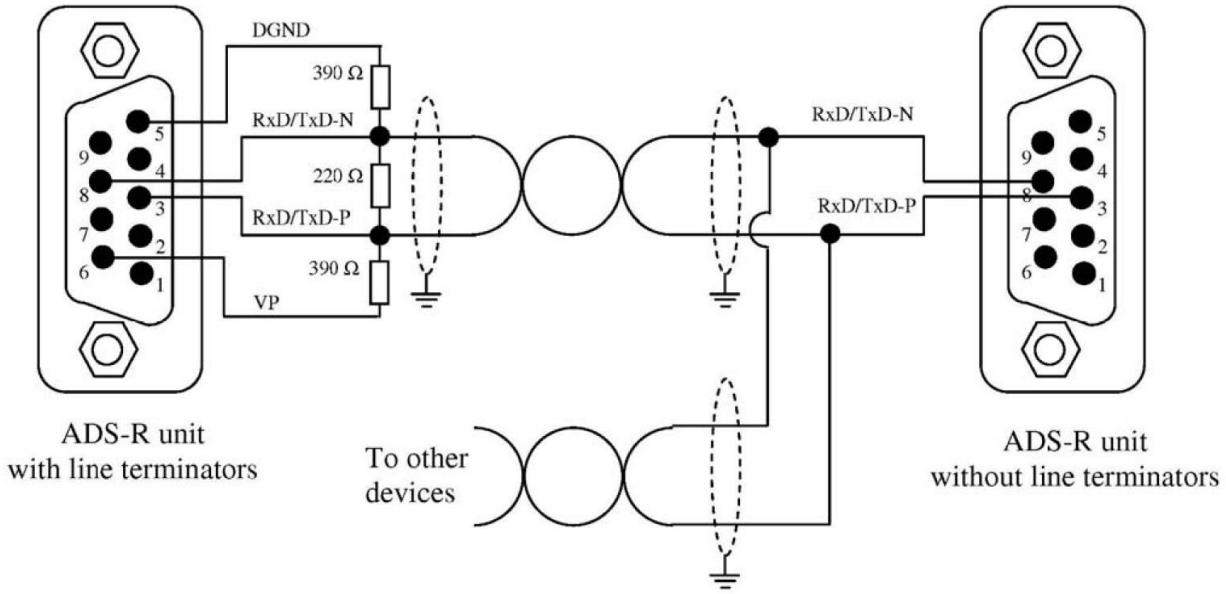
MAXIMUM VALUE FOR THE ANALOG OUTPUT

Using the parameters " **FS Uo** " and " **FS Io** " it is possible to set a measured value for which we want the analog output at their maximal values; lower measured values will be scaled proportionally according to the what it is set as a maximum.
The unit is supplied with the parameters " **FS Uo** " e " **FS Io** " at the default value of " 9999 ", thus for having a correspondence between the value on the display and the analog voltage in V. Changing this value, the correspondence will be delete.

profibus dp expansion

WIRING

The amplifier unit ADS-R, when the Profibus DP expansion card is present, is supplied with a 9 pin D-SUB IP 20 connector, to be wired according to the following drawing; in order to protect the system against electromagnetic radiated interference it is suggested to use a shielded profibus cable.



It is mandatory to install the bus terminations both at the start and at the end of the bus line. So, as long as these terminations must be supplied with the VP signal, it is always necessary to power up the two units on the bus ends. According to the EN50170 the max cable length depends on the bus speed as in the table:

Trasmission speed (kbit/s)	**Max cable lenght (m)**
9.6 , 19,2 , 93.75	**1200**
187.5	**1000**
500	**400**
1500	**200**
3000 , 6000 , 12000	**100**

These specifications are based on a type A cable with the following parameters:

Impedance	135 ÷ 165 Ω
Capacity	< 30 pF / m
Loop resistence	: 110 Ω / km
Wire diameter	> 0,64 mm
Conductor area	0,34 mm²

DATA EXCHANGE

The ADS-R exchanges with the Profibus DP link only the acquired analog value from the strain gauges bridges, as displayed on the local display. All the other hardware resources on the unit are to be managed on local interface.

• The ADS-R unit transmits a 16 bits word with the reading of the load cell; the most important byte is the first to be transmitted.
• When present , the expansion card with the second input for load cells, the unit ADS-R transmits three words at 16 bits: the two measured values and their mathematic average.

PARAMETERS

The ADS-R unit comprises a set of 26 parametrization bytes, the first 7 related to the DPv0 functionalities, other 3 related to the DPv1 functionalities (actually not supported), and the remaining ones are specific for the ADS-R functionalities. The table below shows all the user parameters, togheter with their range.

Byte Nr	Value	Description
0		Status
1	1 ÷ 255	Watchdog factor #1
2	1 ÷ 255	Watchdog factor #1
3	0 ÷ 150	TSDR
4	0xO3	Vendor ID (high byte)
5	0xF8	Vendor ID (low byte)
6		Group ID
7		Reserved
8		Reserved
9		Reserved
11-10	0,970 1950 3900	Acquisition range of the AD converter*
13-12		Reserved
15-14	0 ÷ 9999	Load cells sensitivity *
17-16		Reserved
19-18		Reserved
21-20		Reserved
23-22		Reserved
25-24		Reserved

* the 0 value excludes the setting via Profibus

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