

Application Notes

1 Scope

These application notes are a guide to applying the G123-818 Signal Conditioner. They tell you how to install, connect and adjust the Signal Conditioner. They do not tell you how to design the system in which it is used.

2 Description

The G123-818 Signal Conditioner is typically used with a load cell or other low output transducer and provides a conditioned ± 10 V output and a 4-20mA current output. The 4-20mA output can be selected as unipolar or bipolar. A typical application is where a load cell is the transducer used in conjunction with Moog servo actuators.

A wide adjustment range is provided for excitation, span and zero to allow the majority of commercial load cells to be accommodated.

Calibration using a precision shunt resistance is supported. Two shunt sources are provided. Either the on board plug-in resistors or an external user provided shunt can be selected by Dip switch.

The G123-818 Signal Conditioner can also be used as a stand-alone instrument for static or dynamic force measurement, outputting a scaled \pm DC voltage or current.

Refer also to data sheet G123-818.

3 Installation

3.1 Placement

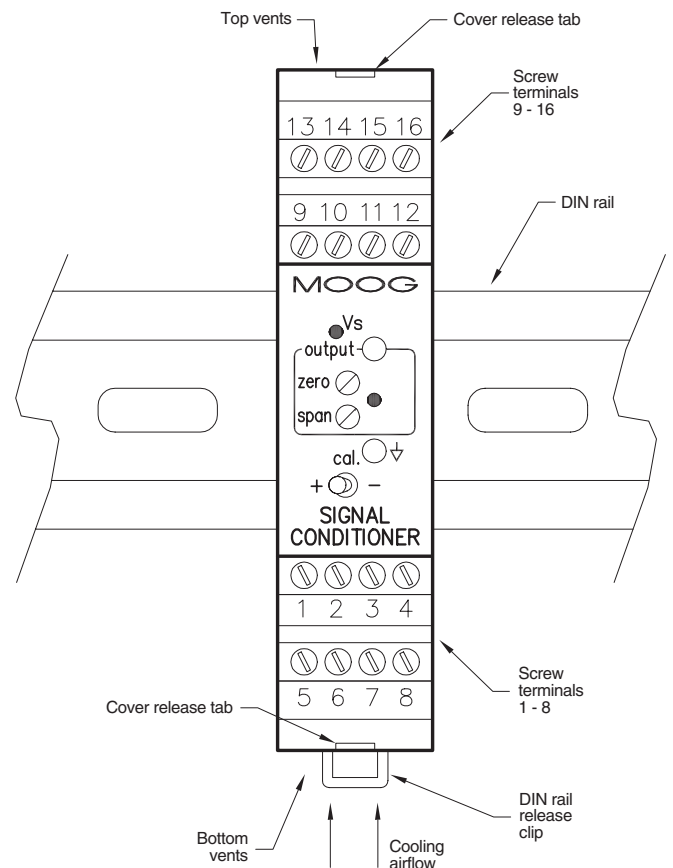
A horizontal DIN rail, mounted on the vertical rear surface of an industrial steel enclosure, is the intended method of mounting. The rail release clip of the G123-818 should face down, so the front panel and terminal identifications are readable and so the internal electronics receive a cooling air flow. An important consideration for the placement of the module is electro magnetic interference (EMI) from other equipment in the enclosure. Always check the EMC compliance of other equipment before placing the G123-818 close by.

3.2 Cooling

Vents in the top and bottom sides of the G123-818 case provide cooling for the electronics inside. These vents should be left clear. It is important to ensure that equipment below does not produce hot exhaust air that heats up the G123-818.

3.3 Wiring

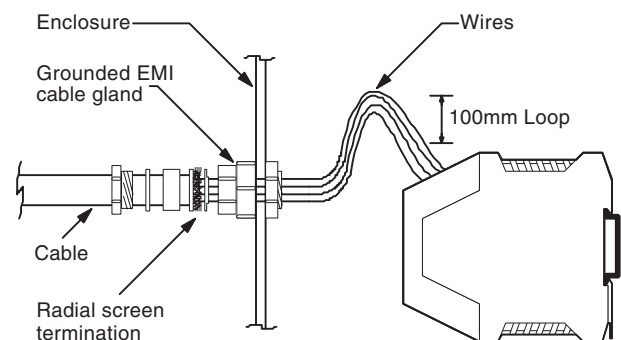
The use of crimp "boot lace ferrules" is recommended for the screw terminals. Allow sufficient cable length so the circuit card can be withdrawn from its case with the wires still connected. This enables the internal switch settings for span and excitation and plug-in filter resistors to be set while the card is still connected and operating. An extra 100 mm, for



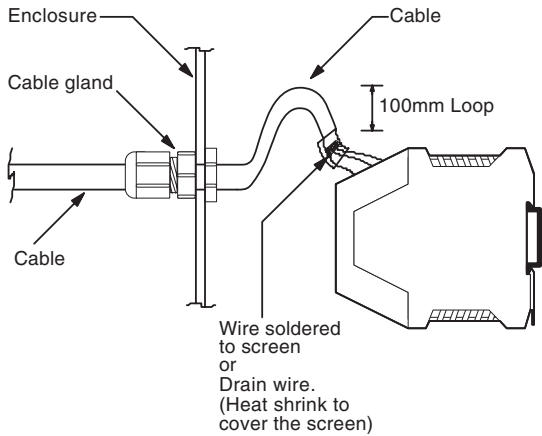
cables going outside the enclosure, as well as wires connecting to adjacent DIN rail units, is adequate.

For the load cell use quality 2 or 3 twisted pair screened cable. One pair is used for the excitation, one pair for the signal and one pair for the excitation sense. For load cell cable lengths greater than 5 m it is recommended to use 6 wire sense connection.

Consult manufacturers instruction for connections as wire colours vary.



Preferred wiring



Alternative wiring

3.4 EMC

The G123-818 emits radiation well below the level called for in its CE mark test. Therefore no special precautions are required for the suppression of emissions. However, immunity from external interfering radiation is dependent on careful wiring techniques. The accepted method is to use screened cables for all connections and to radially terminate the cable screens, in an appropriate grounded cable gland, at the point of entry into the industrial steel enclosure. If this is not possible, chassis ground screw terminals are provided on the G123-818. Exposed wires should be kept to a minimum length. Connect the screens at both ends of the cable to chassis ground. The use of double screened cable for the load cell is suggested in noisy environments.

4 Power supply

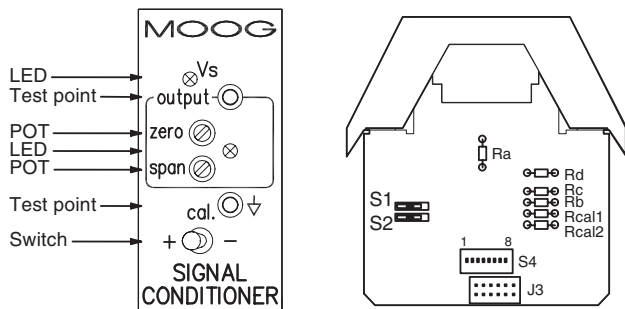
24 V nominal, 22 to 28 V.

100mA @ 24 V with 350 Ω load cell @ 10 V excitation and 20mA output load current.

If an unregulated supply is used the bottom of the ripple waveform is not to fall below 22 V.

It is recommended that the M205, 250mA T (slow blow) fuse, supplied with the unit, be placed in series with the +24V input to protect the electronic circuit. There is a spare fuse in the cover of the fuse holder. Replacement fuses should be compliant with IEC 127-2 sheet 3.

5 Set-up adjustments



(Refer to tables in Section 8 for DIP switch settings and resistor plug-ins)

5.1 Connection

Where the load cell is remote from the G123-818 and where variation in ambient temperature occurs during measurement, 6 wire connection should be used. This ensures constant excitation at the load cell.

5.2 Excitation

It is beyond the scope of these application notes to recommend excitation levels. Consult the load cell manufacturers data to determine the excitation voltage.

- Switches S4.4 and S4.5 select 5 V or 10 V excitation.

- Switch S4.2 allows excitation to be disconnected so noise can be measured with a load cell connected. To prevent excitation flowing through the sense wire, 4 wire connection should be selected by setting S4.3 to off.

5.3 Filter

- Filter frequency should be configured appropriately for the load cell and application, refer to table in section 8.

Filter frequencies in the range 5 to 1000Hz can be obtained by selecting appropriate plug-in resistors.

The default corner frequency for the low pass filter is 1000Hz.

The resistors used should be 1% tolerance, 50ppm/°C tempco, metal film, "1/4 W size".

Suggested types are:

- Roderstein MK2 0207
- Beyschlag MBB 0207

5.4 Input sensitivity

- Select the sensitivity range that suits the load cell you are using.

Example:

A 350 Ω load cell with a 2.0 mV/V sensitivity will have a full scale output of 20mV at 10 V excitation. Span range 2 (12 to 26mV) will allow output to be scaled up to ±10 V.

- With no load applied, adjust front panel Zero trimpot to give 0 V out at the front panel output test point.
- With a known load applied or a simulated load using shunt calibration, adjust the Span trimpot to give the desired scaled output. Shunt calibration procedure is described in section 5.6.

The output should not be greater than ±10 V.

Example:

A load cell with a 1000kg full scale capacity can be scaled by the application of 100kg and adjusting the output to read 1.000V. The scaled output is then 10mV/kg.

5.5 Output

Both ±10 V and 4-20mA outputs are provided and can be used simultaneously.

The 4-20mA current output can be configured for unipolar mode or bipolar mode by slide switches S1 and S2.

- Unipolar mode: S1, S2 = +10 V.
- Bipolar mode: S1, S2 = ±10 V.

In bipolar mode 0 V at the voltage output produces 12mA on the current output.

5.6 Shunt calibration

Where direct calibration using a known load is not possible, shunt calibration provides an output for a simulated strain.

A calibration resistance of 174,650 Ω simulates 1000 μstrain with a 350 Ω load cell and gauge factor of 2.0.

For other load cell resistances the strain values can be determined from the following relationships.

- Rcell = Load cell resistance
- Rcal = Calibration resistance
- ε = μStrain
- GF = Gauge Factor

The relationship between the resistance change ΔR and the simulated strain is:

$$\frac{\Delta R}{R_{cell}} = GF \times \epsilon$$

The resistance change by applying the shunt across one arm of the load cell bridge is:

$$\frac{\Delta R}{R_{cell}} = \frac{R_{cell}}{R_{cal} + R_{cell}}$$

For $R_{cal} = 174,650 \Omega$ with a 350Ω load cell at $10 V$ excitation $\Delta R/R = 0.002$. The voltage at the load cell output with the shunt applied is $5mV$.

Example:

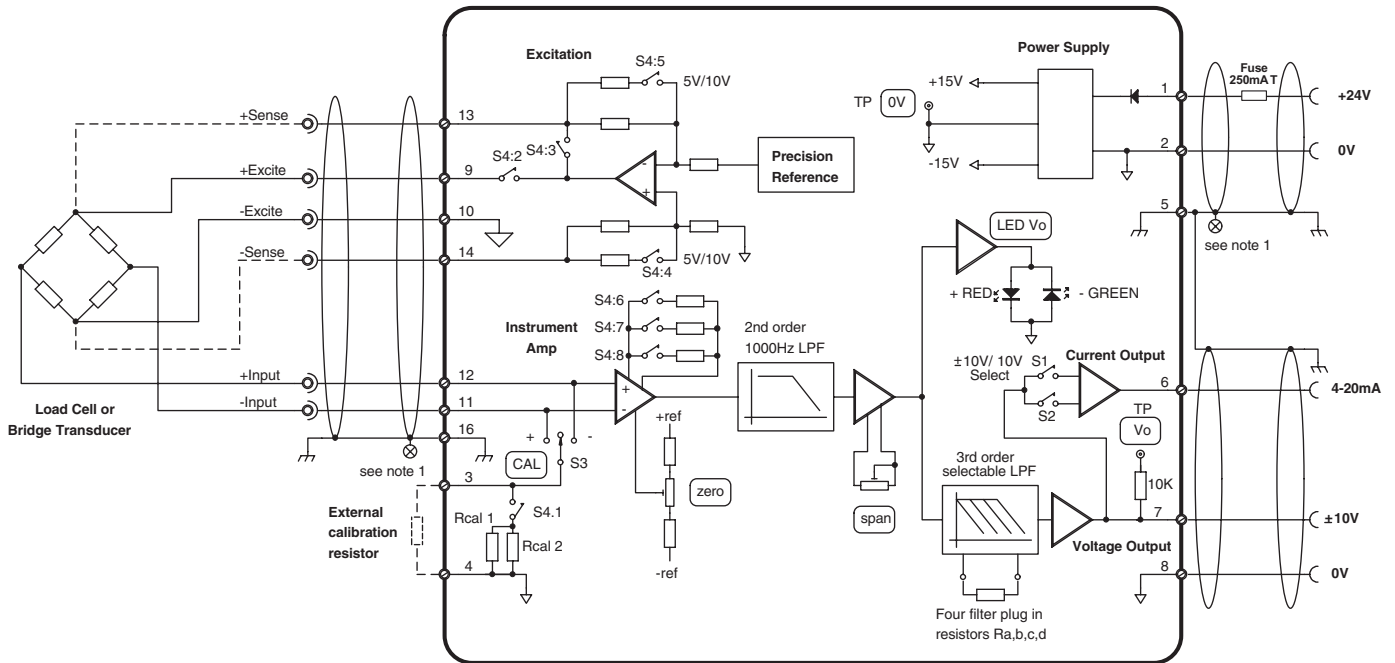
The full scale output for a $1000kg$ load cell with $2.0mV/V$ sensitivity at $10 V$ excitation is $20mV$. The calibration shunt application produces a load equivalent of $20/5mV = 250kg$. The output can be adjusted to read $2.500V$. The scaled output is then $10mV/kg$.

The Cal switch can apply the shunt to produce both + and – simulated strains.

- The internal precision calibration resistance can be disabled and an external calibration resistance connected between terminals 3 and 4.

Two on board calibration plug-ins are supported. $R_{cal} 1$ and $R_{cal} 2$ are connected in parallel to allow desired value to be obtained from common values. No resistors are supplied by Moog plugged into $R_{cal} 1$ and $R_{cal} 2$.

8 Block-wiring diagram



4-20mA mode	S1	S2
Unipolar*	+10	+10
Bipolar	±10	±10

Input sensitivity for full scale out. (mV)	S4.8	S4.7	S4.6
1: 24 – 52	on	off	off
2: 12 – 26	off	on	off
3: 6 – 13*	off	off	on

Excitation voltage (V)	S4.4	S4.5
5.0*	on	on
10.0	off	off

Connection mode	S4.3
4 wire*	on
6 wire	off

Excitation enable	S4.2
Excite on*	on
Excite off	off

Calibration select	S4.1
Internal shunt	on
External shunt*	off

	Filter plug-in resistances					
Frequency (Hz)	5	10	50	100	500	1000*
R _{a,b,c} (kΩ)	910	470	91	47	9.1	4.7
R _d (kΩ)	300	150	30	15	3	1.5

* = Factory defaults.

The calibration resistance should be a precision type 0.1% tolerance, 15ppm/°C tempco, metal film, "1/4 W size".

A suggested type is: Welwyn RC55YB

6 Test points and indicators

- The output LED shows the polarity of the output signal. The LED is off for zero output.
- The output and 0 V test points allow the actual filtered output signal to be measured while adjusting zero and span.

7 Withdrawing the circuit card from its case

The circuit card needs to be withdrawn from its case to select gain range, excitation voltage and filter frequency.

To do this, push one tab in with a pen or screwdriver while gently pulling on the top cover on that side. The cover will release approximately one mm. Repeat on the other side and withdraw the cover and circuit card until the required circuit points are exposed. The rigidity of the connecting wires will hold the circuit card in position while the settings are made.

9 Specifications

Functional

Transducer support: 4 wire or 6 wire lead compensation, 120 Ω minimum

Transducer excitation: selectable +5 or +10 V, 40mA max.

Output: ± 10 V @ 10mA.
4-20mA unipolar, or
4-20mA bipolar, 12mA = no load

Internal switches:

Connection: 4 wire or 6 wire transducer
Full scale span range: 1: 24 to 52mV
2: 12 to 26mV
3: 6 to 13mV

Calibration select: Internal or external user shunt
Excitation: 5 or 10 V and on/off selection

Switch functions also available on test header for remote configuration.

Filter: Low pass, 3rd order, selectable by four plug-in resistors
Frequency range 5 to 1000Hz

Front panel adjustments:

Span: 15 turn trimpot
Zero: ± 2.5 % full scale by 15 turn trimpot
Shunt calibration: Centre off, \pm shunt connection, toggle switch

Rcal resistors: Not supplied

Front panel LED's: Vs, internal supply = green
Vo, output polarity, positive = red
negative = green, zero = off

Front panel test points: Vout and 0 V, 2mm test plug

Environmental and physical

Supply: +24 V nominal, +22 to +28 V range.
100mA @ 24 V supply, with 350 Ω load cell, 10 V excitation and 20mA output load current

Recommended supply protection: M205, 250mA T (slow blow) fuse compliant with IEC 127-2 sheet 3

Mounting: DIN rail

Class of protection: IP 20

Operating temperature range: 0 - 40°C

Dimensions: 100W x 108H x 22.5D

Weight: 140g

Approvals: CE Mark: EN50081.1 emission
EN61000-6-2 immunity

C tick: AS4251.1 emission

Performance

Input impedance: >10 M Ω

CMRR: >100 dB @ gain = 200

Noise: <5 μ Vp-p 1 to 1000Hz RTI,
350 Ω input

Temp stability: <200 μ V/°C RTO, 0 to 40°C

Drift: <5mV RTO 30min to 24 hour

Linearity: < ± 0.05 % FS at DC

Input protection: ± 40 V

Output protection: Short circuit current limited

Internet Data

For a detailed Data Sheet and the latest version of this Application Note please refer to the Moog website www.moog.com/dinmodules

MOOG

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