MOOG

Application Notes

1 Scope

These application notes are a guide to applying the G123-825 Buffer Amplifier. They tell you how to install, connect and adjust the Buffer Amplifier. They do not tell you how to design the closed loop system in which it is used.

2 Description

The G123-825 Buffer Amplifier provides two types of interfaces and a filter.

2.1 PLC ±10V and 4-20mA

It interfaces between standard PLC analogue output modules, on one side, and a Moog valve, on the other. It simplifies the use of a PLC in closed loops.

The Buffer Amplifier solves the common problem of the 4-20mA or ±10V PLC output being incompatible with the valve drive requirements.

2.2 Mechanical feedback valve

It interfaces between the current output of a servoamplifier, on one side and a Moog valve, on the other. This enables old mechanical feedback (mfb) valves to be replaced by modern electrical feedback (efb) servo and proportional valves, without changing the servoamplifier. The buffer amplifier takes the existing servoamplifier output and converts it to an efb compatible signal.

2.3 Filter

The buffer amplifier provides a filter to remove noise from the input signal.

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 G123-825 should face down, so the front panel and terminal identifications are readable and so the internal electronics receive a cooling airflow. An important consideration for the placement of the module is electro magnetic interference (EMI) from other equipment in the enclosure. For instance, VF and AC servo drives can produce high levels of EMI. Always check the EMC compliance of other equipment before placing the G123-825 close by.

3.2 Cooling

Vents in the top and bottom sides of the G123-825 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 G123-825.
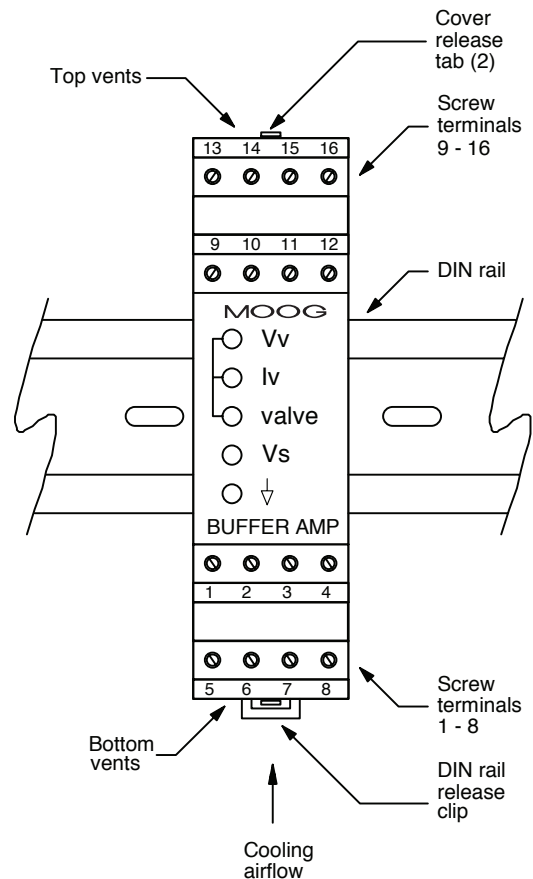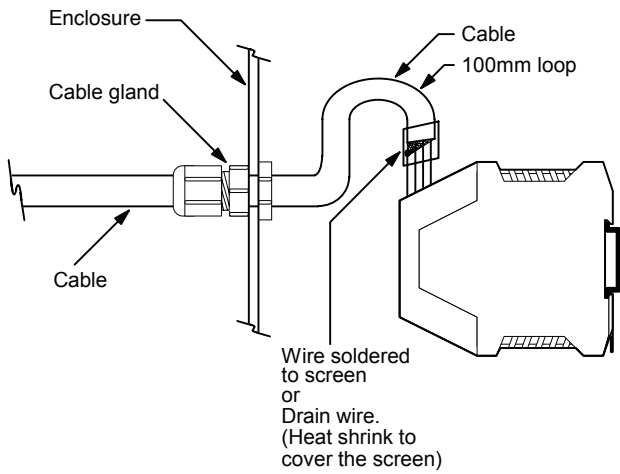

3.3 Wiring

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 switches to be changed on the circuit card while the card is still connected and operating. An extra 100mm, for cables going outside the enclosure, as well as wires connecting to adjacent DIN rail units, is adequate.
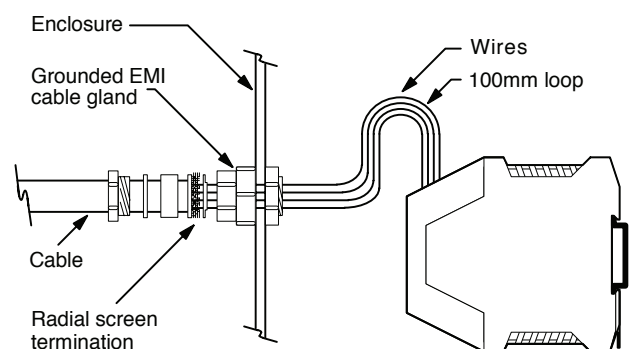
Preferred wiring

Alternative wiring

3.4 EMC

The G123-825 emits radiation well below the level called for in its CE mark test. Therefore, no special precautions are required for 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 G123-825. Exposed wires should be kept to a minimum length. Connect the screens at both ends of the cable to chassis ground.

4 Power supply

24V nominal, 22 to 28V
65mA @ 24V, no output current. 170mA @ 100mA, output current.

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

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
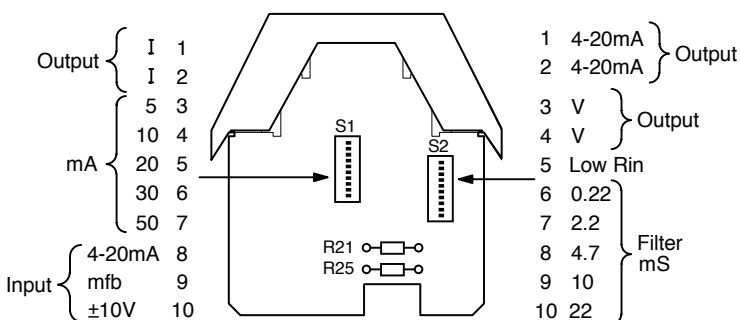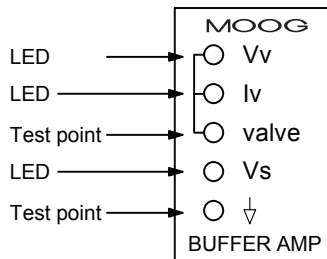
The buffer amplifier is shipped in the following default condition.

SW1	1	Output I	on
	2	Output I	on
	3	Output 5mA	off
	4	Output 10mA	off
	5	Output 20mA	off
	6	Output 30mA	off
	7	Output 50mA	on
	8	Input 4-20mA	off
	9	Input mfb	off
	10	Input ±10V	on
SW2	1	Output 4-20mA	off
	2	Output 4-20mA	off
	3	Output V	off
	4	Output V	off
	5	Low Rin	off
	6	Filter 0.22mS	on
	7	Filter 2.2mS	off
	8	Filter 4.7mS	off
	9	Filter 10mS	off
	10	Filter 22mS	off

R21 and R25 390k for ±50mA input.

5.1 Input signal ±10V

Connect this signal to terminal 3 and select ±10V on SI:10. Terminal 10 is the 0V reference. Ensure the other two input signal switches, SI:8 and SI:9, are off.

5.2 Input signal 4-20mA

Connect this signal to terminal 4 with terminal 8 as the return. Terminal 7 is the 0V reference and must be connected to the 0V reference of the PLC generating the 4-20mA signal. Select 4-20mA on SI:8. Ensure the other two input signal switches, SI:9 and SI:10, are off.

5.3 Input signal mfb

Connect this signal to terminal 4 with terminal 8 as the return. Terminal 7 is the 0V reference and must be connected to the 0V reference of the servoamplifier generating the mfb signal. Select mfb on SI:9. Ensure the other two input signal switches, SI:8 and SI:10, are off.

The input amplifier needs to be set up to suit the mfb current. From the table select the value of resistors R21 and R25 to suit the input mfb current and plug them into the sockets on the circuit board.

The plug-in resistors are "quarter Watt" 1% metal film. Two suitable types are Beyschlag MBB0207 and Roderstein MK20207.

mfb current	R21 and R25
±100mA	200K
±50mA	390K
±40mA	510K
±30mA	680K
±20mA	1M
±10mA	2M
±7.5mA	2M7

5.4 Digital noise filter

This filter removes the digital quantization noise, due to the PLC update period, in the PLC output signal. Because PLC's can have low frequency period noise that the valve can respond to, it is important to remove this update rate noise so the valve does not buzz and the process does not respond. The update period of the PLC needs to be known so the correct filter time constant can be selected. Initially set the filter period to be equal to the update rate. The switch time settings add together, so if you need 15mS, select 10 and 4.7.

When the system is operating, a final check of the time constant can be made. If the valve buzzes, a greater time constant is required. If the valve does not buzz, reduce the time constant until buzzing is detected, then increase it until the buzzing just stops.

To calculate the 3dB frequency roll off point, use the formula:

$f = \dfrac{159}{T}$ Hz, where T = the sum of mS period switches selected.

5.5 Low Rin

The "low Rin" switch drops the input resistance for the PLC ±10V signal from 100k Ohm to 1k Ohm. This can improve the noise immunity of the signal. Be sure the PLC output can deliver the ±10mA that is needed when low Rin is selected.

5.6 Valve drive signal

Select the output signal to match the valve requirement. If voltage is selected on the I/V switches, the maximum output current is ±10mA. If current is selected, the full scale current output will then need to be selected on the valve current switches. The switch current settings add together, so if 45mA is required, select 30, 10 and 5mA. Maximum output current, in current mode, is ±100mA.

When 4-20mA is required, select I on the I/V switches, 4-20mA output switches on, and 20mA on the output current switches.

6 Test points and indicators

The Iv and Vv LEDs show the polarity and level of the selected output signal.

The valve test point gives the actual voltage on the valve output terminal. When the output signal is selected as current, a knowledge of the valve's input resistance is needed to interpret the test point signal. For instance, if 10mA is selected and a valve with 200 Ohm input resistance is connected, the signal on the valve test point will be 0 to ±2V.

7 Access to internal settings

The circuit card needs to be withdrawn from its case to set the digital noise filter switches, to select the input signal type, the mfb current, the output signal type, the output current and low Rin.

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 millimetre. Repeat on the other side and then withdraw the cover and circuit card until the required switches are exposed. The rigidity of the connecting wires will hold the circuit card in position while the switches are set.

8 Specifications

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Signal input:	4-20mA 0 to ±100mA 0 to ±10V
Current signal input:	Terminals 4 to 8. 50 Ohm
Voltage signal input:	Terminal 3. 100k Ohm or 1k Ohm with low Rin selected.
Valve drive outputs:	0 to ±10V @ 1k Ohm min load 4-20mA @ 500 Ohm max load 0 to ±100mA max max load $= \left(\dfrac{11V}{I\,(Amp)} - 39\right)$ Ohm
Valve drive current selections:	±5, 10, 20, 30 & 50 mA
Valve drive test point:	Zo = 10k Ohm

Vv LED:	Maximum illumination at ±10V.
	  + = red
	  − = green

Iv LED:	Maximum illumination at ±5mA to ±100mA.
	  + = red
	  − = green

Vs LED:	Internal supply, OK = green
Valve filter type:	Active, single pole
Valve filter corner frequency selections:	7, 16, 34, 72 & 723 Hz, ±10%
Supply:	Terminal 1 24V nominal, 22 to 28V 65mA @ 24V, no output current 170mA @ 100mA output current
Recommended supply protection:	M205, 250mA T (slow blow) fuse compliant with IEC 127-2 sheet 3.
±15V output:	Terminals 12 and 16, ±(110mA - max valve current)
Terminal 10 max current:	500mA. If terminal 10 is used to power a proportional valve, the terminal 1 supply fuse should be increased to cater for the extra current.
Mounting:	DIN rail
Class of protection:	IP 20
Temperature:	0 to 40°C
Dimensions:	100 W x 108 H x 22.5 D
Weight:	120 g
CE mark:	EN50081.1 emission EN50082.2 immunity
C tick:	AS4251.1 emission

9 Block wiring diagram
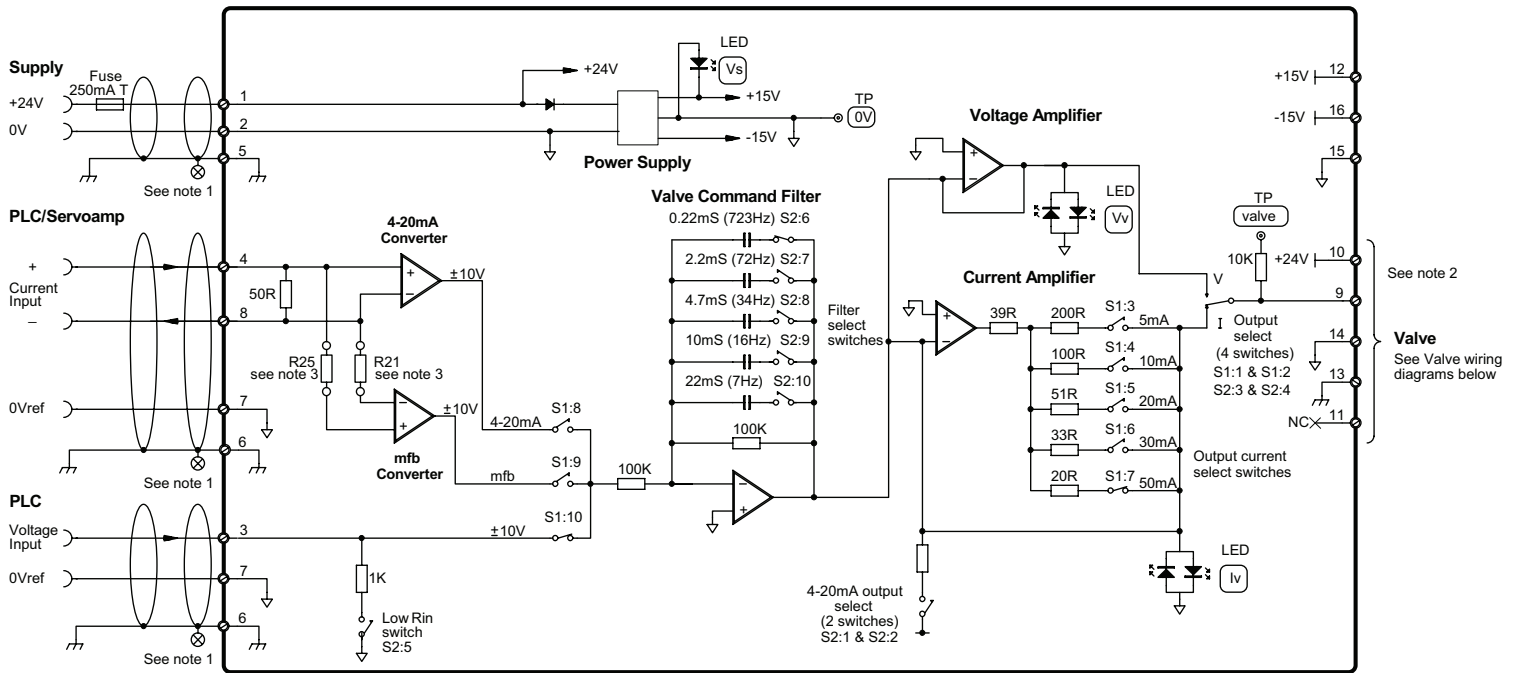
Notes:
1. Connect cable screen to enclosure cable gland.
2. Terminal 10 max output current is 500mA. It cannot power a DDV.
3. R21 and R25 are 1/4W plug-in resistors on P.C.B. to select mfb input current. Default 390K. See 5.3.
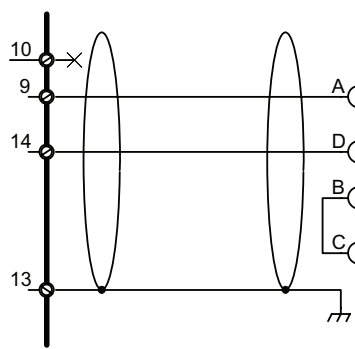4. Switches shown in default positions.

Typical valve wiring diagrams

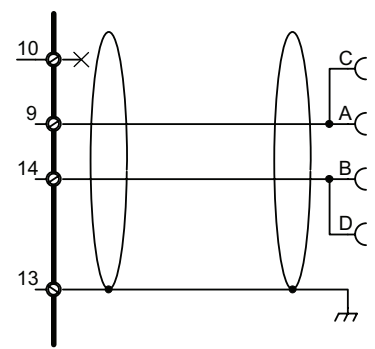Consult specific valve data sheets for exact connector pin designations.

9.1 Proportional valve (efb)
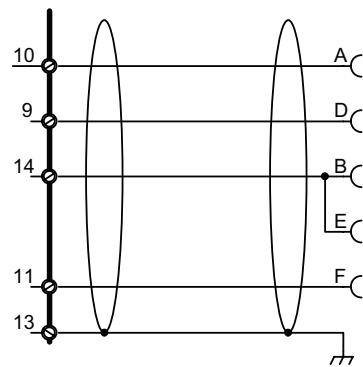
9.2 Servovalve (mfb) series coils

9.3 Servovalve (mfb) parallel coils

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

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