APPLICATION NOTE CX-RLY-101

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Using CX-RLY Module for Loop Power, 4-20 mA Output Vibration Sensors

1. Introduction

The purpose of the 4-20 mA analog current loops is to transmit the signal from an analog vibration sensor to the distance, as a current signal. The loop power sensors output a 4-20 mA current, that is proportional to the overall vibration of the equipment or machinery they monitor. The range of the output current is about 4-20 mA (4 mA normally represents the sensor zero-level output, and 20 mA represents its full-scale output).
Only two wires are required to send the current signal and to ensure the power supply of the sensor.
A loop supply voltage is used to power the remote sensor. The remote sensor regulates the loop current so that the loop current represents the value of the parameter being measured by the sensor. A series resistor RL at the loop power supply converts this current to a voltage that can be used by the process monitor/controller to record the parameter being measured.

The Loop Power Sensors are available from different suppliers or may be ordered directly to
 MainTech Sweden.
- LP250 Series 4-20 mA Low Cost Velocity Sensors:
http://www.ctconline.com/__lp250_series_4_20_ma_low_cost_velocity_sensors_.aspx?qcwg=116_859&qman=

- LP202 Series Loop Power Sensor:
http://www.ctconline.com/fileup/PrdDS2013/6_PRO_LP202_DS.pdf?nameddest=LP202

The measurement range, measurement type and units are fixed and must be established when ordering the sensor.

Example:
LP200 Series 4-20 mA Velocity Sensors
Loop Power Sensor, Velocity, 4-20 mA Output

Stud Type	Measurement Range	Range Type	Frequency Range +/- 3dB
M = M6x1 (blank for 1/4-28)	**0** = 0-0.5 IPS (0-12,7 mm/sec) **1** = 0-1 IPS (0-25,4 mm/sec) **2** = 0-2 IPS (0-50,8 mm/sec) **3** = 0-10 mm/sec (0-0,4 IPS) **4** = 0-20 mm/sec (0-0,8 IPS) **6** = 0-5 IPS (0-127 mm/sec)	**R** = RMS **P** = Peak	**1** = 600-60,000 CPM (10-1000 Hz) **2** = 180-150,000 CPM (3-2500 Hz) **3** = 180-60,000 CPM (3-1000 Hz) **4** = 180-300,000 CPM (3-5000 Hz) **5** = 180-600,000 CPM (3-10000 Hz)

This paper describes step-by-step, how should be configured the CX-RLY unit for a loop power velocity sensor type LP202-3-R-1 (having a measurement range of 0-10 mm/sec RMS).

2. Typical Loop Powered Circuit
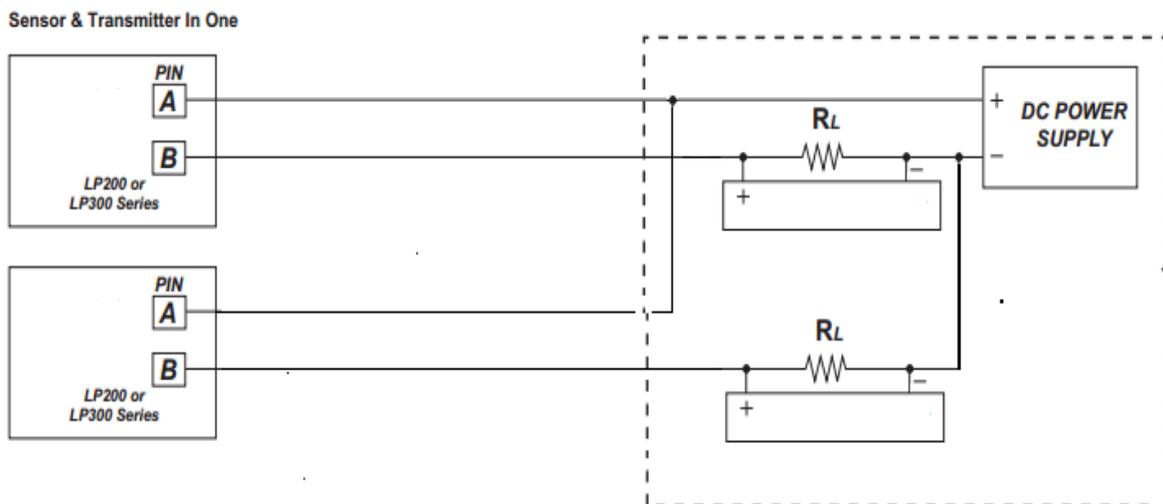
All sensors can be power supplied (+24 V D.C.) from a single power supply unit.
Each sensor can be connected to a receiver (Digital indicator, process recorder, a.s.o.).
As can be seen from the above schematic, the minus (COM) point of the power source is connected directly with the minus (COM) of the receivers.

Instead of using four separate receivers, a single CX-RLY unit can be used to receive the vibration measurements from 2-4 field transducers.

In this paper, for simplicity, is shown the basic wiring diagram only for two transducers, but the schematic can be adapted easily for 3 or 4 transducers.

3. Typical Wiring diagram
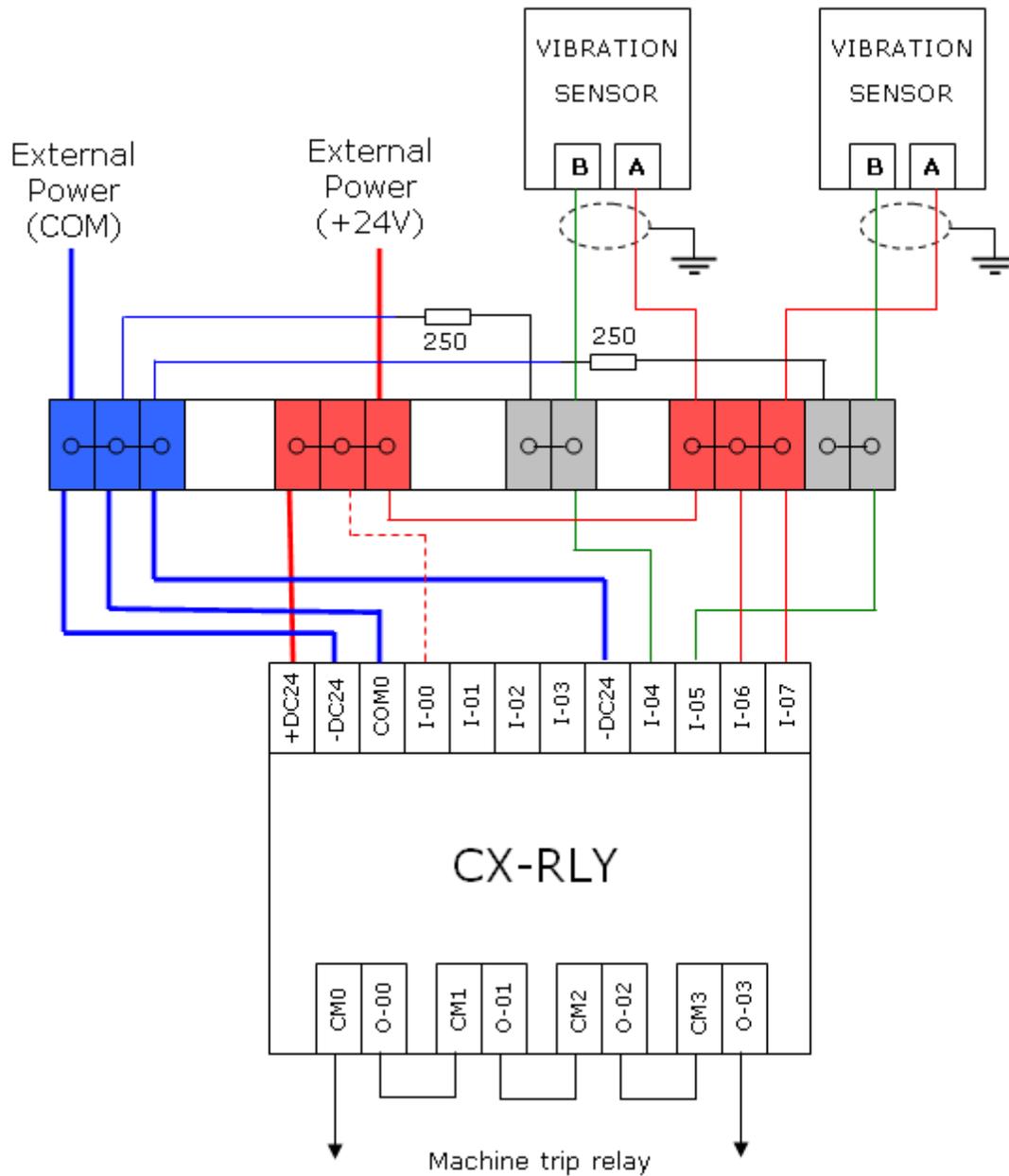
In above wiring diagram the +24 V power supply is considered to be external.
To transform the transducers signal into voltage, two 250 Ω (0.1%) resistors are used.
The output signal of 4 to 20 mA will be transformed in a voltage range of 1÷5 V, suitable for CX-RLY Module.

4. CX-RLY Module Configuration

4.1 Hardware configuration

Wire size:
- Minimum: 0.14 mm^2 (26 AWG)
- Maximum: 1.5 mm^2 (16 AWG)

Don't connect two cables to a single terminal block hole. Use an additional terminal strip, as shown above.

Because the input 3 and 4 are unused, the I-06 and I-07 is connected to +24 V.
Connect the sensors as shown in the wiring diagram.
To avoid Module programming, don't connect the I-00 terminal in this stage, just let it free. (This jumper locks the Module keypad).

Connect the relays contact to the trip system.
Remember that the normal position of the relay contact can be NO or NC [depending on the hardware settings (I-03 input)].

Now the Module is ready to be started and settled for the application.
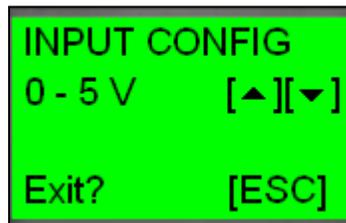
4.2 Software configuration

After applying the power, an initialization task will be performed.
In a few seconds, the MAIN screen will appear:

Only two channels are shown (we disabled the 3rd and 4th cannels).
Press ESC key to access the INPUT selection screen:

The default input range (0÷5 V) is selected.
Use the ▲/▼ arrows to change the voltage input range between 1÷5 V.
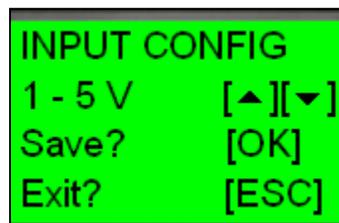
Press OK to save the settings.
Press ESC to return to the Main menu.

To configure the channels, use the ▲/▼ arrows, select the channel and press OK.
The setting menu for the selected channel will become active.

For each channel you can set the followings:
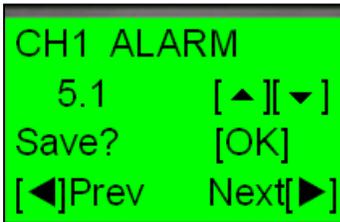- Vibration range
- Alarm level
- Alarm delay.

VIBRATION RANGE SCREEN

CH1 RANGE
10.0   [▲][▼]

[◄]Main   Next[►]

This is the first screen in the programming sequence:

The default range is 10 (mm/sec RMS). Because our transducers have exactly this range, just press ► to go to the ALARM screen.

ALARM SCREEN

CH1 ALARM
5.1   [▲][▼]
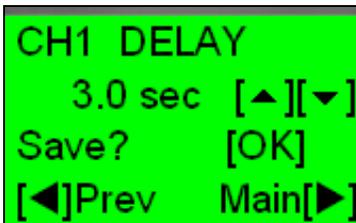**Save?   [OK]**
[◄]Prev   Next[►]

The initial alarm value is 5.0.
Use the ▲/▼ arrows to change the value as required in your application. If the alarm value is changed, the third line will also appear. Press OK to save your settings.
Press ► to go to the DELAY screen.

DELAY SCREEN

CH1 DELAY
3.0 sec [▲][▼]
Save?   [OK]
[◄]Prev   Main[►]

You may set a delay for the relay action.
The default value is 1.0 sec.
If you set the zero value, it will be no delay in the relay action.
Press OK to save your settings.
Press ► to return to the MAIN screen.

Follow the steps above for channel no. 2, as well.

To avoid unauthorized setting changes, make a link between the I-00 terminal and +24 V. Now the keypad will be disabled.

NOTE: As default, the normal relay position is FAIL SAFE. This means without alarm the output contact is closed and the relay coil is energized.
If an alarm occurs OR a power loss occurs, the relay contact will be placed in the OPEN position and it will stop the machine.

If you don't like this arrangement, just make a link between the I-03 terminal and +24 V. From now on, the relay contact will CLOSE in an alarm condition.

Now the Module is ready to work. All the software settings already done will be saved in the controller flash memory forever.

NOTE: *The software configuration may be performed into the shop, before mounting the CX-RLY Module. Just supply the Module with a +24 V power.*

4.3 Optional configuration

Two external signals can be used to add more functionality to your Module.

4.3.1 Alarm inhibit

You can mount a key-switch between the I-02 terminal and +24 V.

When the switch is closed, the relay will be placed onto the safe position (non-alarm), either NO or NC.
Now, it will be safe to adjust the settings directly in the field, without generating a false alarm.
This facility is usefully in troubleshooting purpose and for short time.
Remember if this contact is closed, the machine remains unprotected against high vibrations.

4.3.2 STARTUP

It's a normal fact to get a higher vibration level during the machine startup.
To activate the Alarm Inhibit functions during startup, as described above is not the best practice, because the machine remains unprotected in a very sensitive moment.
That's why the CX-RLY Module has implemented a special feature to be used during the startup procedure.
If the I-01 terminal is temporary connected to +24 V exactly with the startup time, the alarm level will be doubled for 10 seconds. Only a pulse is required (a transition from the unconnected status to the +24 V status of the I-01 input).
That's how the machine will be still protected during startup, to avoid excessive vibrations that may damage the machine.
A free relay contact from the electrical sub-station is required (an auxiliary contact of the machine start relay).

5 Conclusions

Using the CX-RLY Module, a low cost machinery protection can be implemented.
No special skills are required to protect your machine. You can do this by yourself.
Before proceeding, just read carefully the CX-RLY USER MANUAL to find more details regarding the environmental restriction.