

## 4-20mA Loop setup for the TruSense S\_30 Sensors

**Overview:** This document is for wiring the TruSense S\_30 series instruments in a two wire, three wire or four wire current loop. Recommended voltage for loop is 24 volts DC but the TruSense S\_30 will operate from 12 to 28 volts DC. **Important:** Installer must take line voltage drops into account for extended loop wiring when installing the TruSense.

Since the TruSense does not supply loop power, two power sources must be taken into account. The first would be the power for the current loop and the second is an isolated power source for the TruSense sensor. Power supply isolation is important to protect the TruSense and insure accurate current output reading from the TruSense instrument.

***Warning: When installing the TruSense into plant wiring, power from DC supply needs to be off and all ground wire to be connected first (DC sensor power ground and Loop Return). If power cannot be turned off, Loop return (-) and DC sensor power ground (-) must be connected first. Next, connect loop 4-20 (+) wire followed by the sensor power 12 to 24 VDC (+).***

**Important: Plant wiring needs to be verified before making connections to TruSense S3\_30.**

In the following sections we will cover Basic 4-20 Loop operation, typical wiring installations recommendation and sensor 4-20 Loop parameter configurations.

### Basic Overview of 4-20mA Current Loop:

This section is for the first time installer to simplify the current loop operation. Basically, the 4-20 current Loop comprises of 3 basic components.

1. Transmitter: LTI TruSense S\_30
2. Receiver: Customer supplied instrument to read the current.
3. Loop Power: Recommended voltage is 24 volts DC (VDC) but the TruSense S\_30 will operate from 12 VDC to 28VDC. **Note:** When determining Loop voltage the installer must also take into account the receiver's requirements.

Figure 1 shows a simplified version of the basic current loop with the TruSense S\_30 instrument installed. Note: The power to operate the TruSense has been omitted for simplicity.

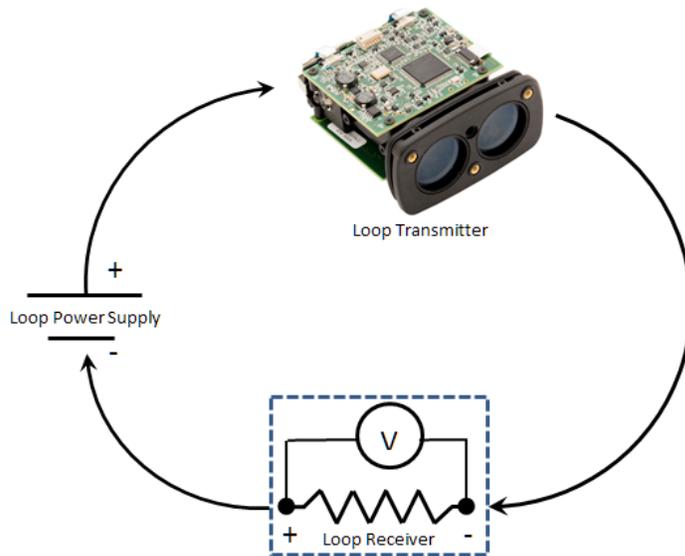


Figure 1

It is important to understand the current in the loop has only one path through the Loop Transmitter (TruSense S\_30) and Loop Receiver in relationship to the Loop power.

The TruSense (Transmitter) will convert distance measurements into current based on the sensor's user parameter configurations and the Receiver will read the current value and process it.

### Typical Wiring Installations:

In most cases, there will be two wires, three wires, or four wires for the 4-20 provided at the location of the Transmitter. The three following examples are common hookups.

**Important:** *The installer must verify actual wire assignments at their facility before hooking up the TruSense instrument to prevent damage to the instrument.*

1. **Two Wire:** One wire will be the 4-20(+) and the other will be the 4-20 (-). A second isolated power source would be used to power the TruSense sensor. See Figure2:

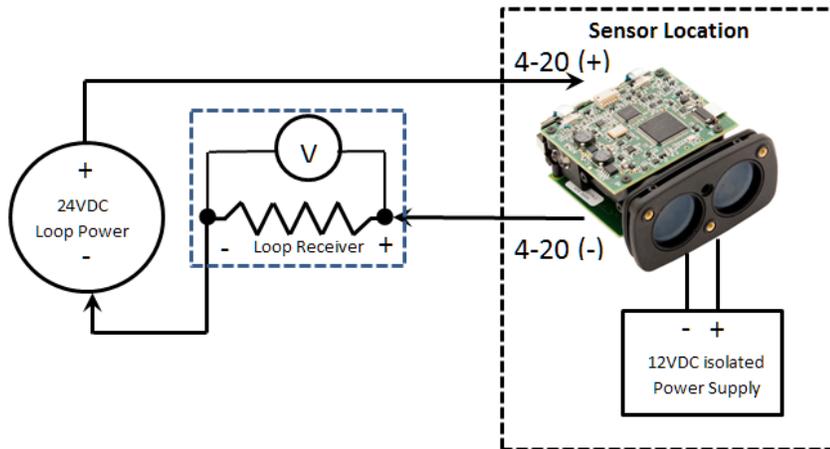


Figure 2

2. **Three Wire:** In this wiring configuration, at the Transmitter location you would have + 24VDC, Common (Ground) and Receiver 4-20 (+). Figure 3 shows leveraging the 24VDC loop power to a DC/DC isolated converter to power the TruSense. The current path for the 4-20 Loop is shown in red. **Important:** The Loop power supply must have a minimum current rating of 350mA to provide enough current for the 4-20 Loop and TruSense S\_30. If the Loop Power supply is shared, it must be rated to supply enough current for each sensor 4-20 Loop.

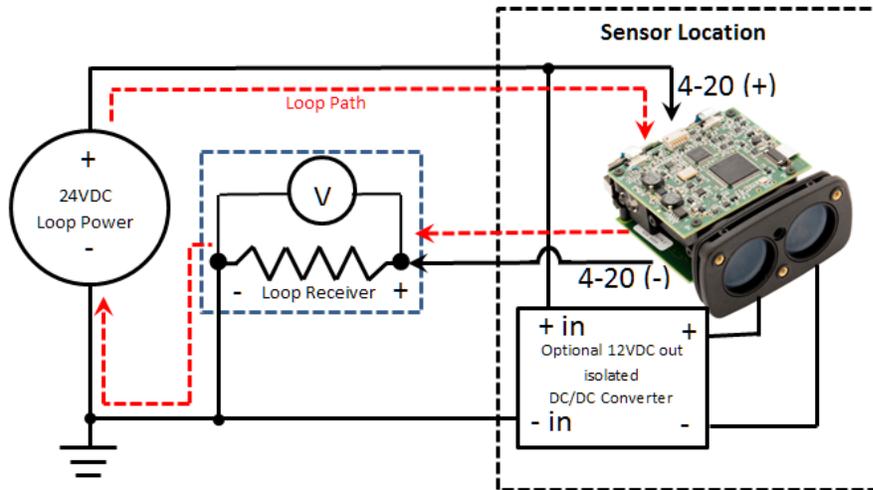


Figure 3

1. **Four Wire:** In this wiring configuration, at the Transmitter location you would have + 24VDC, Common (Ground), Receiver 4-20 (+), and Receiver 4-20(-).Figure 4 shows leveraging the 24VDC loop power to a DC/DC isolated converter powering the TruSense. The current path for the 4-20 Loop is shown in red. **Important:** The Loop power supply must have a minimum current rating

of 350mA to provide enough current for the 4-20 Loop and TruSense S\_30. If the Loop Power supply is shared, it must be rated to supply enough current for each individual sensor 4-20 Loop.

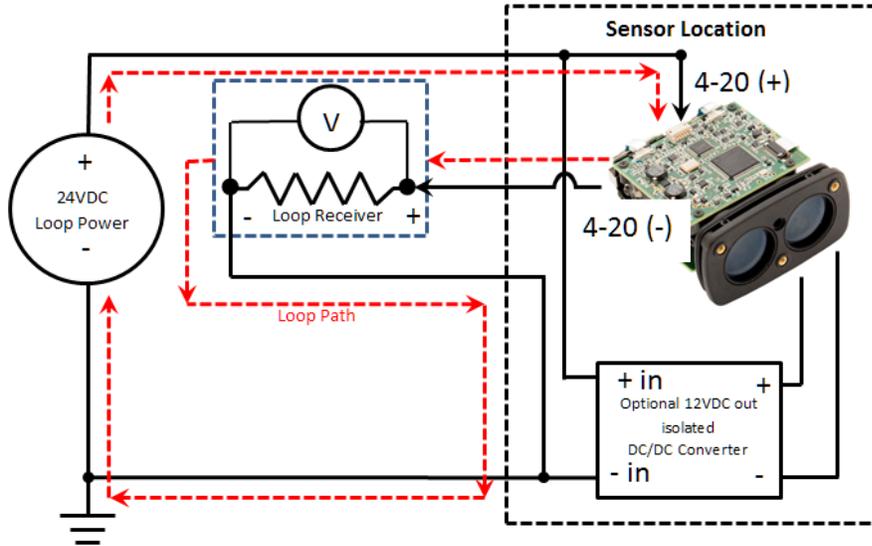


Figure 4

In summary, in all three wiring configurations, the current loop has only one path through the Transmitter (TruSense S\_30) and Receiver in relationship to Loop power. Figures 3 and 4 demonstrated the use of a DC/DC isolated power converter to provide power to the TruSense S\_30. An inexpensive DC/DC isolated converter was tested with the TruSense instrument which was RECOM REC5-2412SRW/H2/A. This device provides 2kVDC isolation and will tolerate loop voltages from 18 to 28 volts DC. **A separate isolated power supply can be used to replace the user supplied DC/DC converter as long as it is isolated from the 4-20 Loop.** For purchase, LTI has a 110/220/AC to 12DV power supply available (OEM /Ruggedized housing part number 7054691). Figure 2 shows the connection. Note: Each sensor would need its own power supply.

### TruSense 4-20 Loop setup command:

Current loop setting can be programmed using the LTI TruSense S2XX Utility or a terminal program like Tera Term. The standard RS-232 is the connection between the PC and the TruSense S\_30.

The simplest way to program the sensor is to run the LTI software tool and use the configure sensor button. Under the 4-20 mA tab you will be able to set up the 4mA and 20mA values, error current, number of measurements before loop update current and the delay between measurements. Another important feature to leverage is the targeting mode under the targets tab. By utilizing this tool it will

change both RS-232 target mode and 4-20 mA target mode reporting. The last tab in the configuration section is measurements. This menu give you options to change the range of the instrument, measurement units to report, offset to apply. Please refer to the manual for detail on each setting.

It is important understand that the LTI tool sends the basic serial commands listed in the user's manual. A user can use a terminal program and send the same commands manually over the RS-232 connection.

Typical terminal setup settings are

- Baud rate: 115200 (Factory default baud but is user selectable)
- Data: 8 bit
- Parity: None
- Stop: 1 bit
- Flow control: Xon/Xoff

Since the TruSense provides no echo, set the terminal program to Local echo on in order to see the commands you are typing before you send them.

For setting up the current loop manually there are two formats to the \$FT command. The short version of the command programs 4mA distance value, 20mA distance values (Note: Distance units are in the same units as the \$MU setting), update period, and error current setting parameters. The long version programs the HART output parameters (PV, SV, TV, QV). It is important to note that the PV (First HART value) position also defines the 4-20 mA loop target mode. The only valid values for the HART PV position when using the 4-20 mA loop is 0-4 (First target = 0, Second Target = 1, Third Target = 2, Strongest Target =3 and Last Target = 4). Below describes the sequence order and format to manually setup the instruments' 4-20 mA loop parameters:

1. \$ST<return> (Note: Stop the instrument from taken measurements)
2. \$FT, <value for 4mA>, <value for 20mA>, <update period>, <error handling>, <number of measurement>, <PV>, <SV>, <TV>, <QV> <return> (Note: This step it is for setting the PV value to the correct targeting mode for the application. If just setting the current loop parameters only, you can omit this step)
3. \$FT, <value for 4mA>, <value for 20mA>, <update period> , <error handling>, <number of measurement> <return> (Note: This step is used to setup the 4-20mA parameters after the targeting mode has been set)
4. \$SU <return> (Note: This step is important to save the new setting in memory so they will be retained during the event of power cycling the TruSense instrument.)

If \$MA is set to 2 (Auto Start, after the \$SU is sent, the instrument will reboot and the 4-20 loop will start to measure in the new parameter settings.