Smart transmitter

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Smart transmitter

HART = Highway Addressable Remote Transducer-. is a communication protocol.
A HART transmitter contains both a conventional analogue mA signal and a digital signal superimposed on top of the analogue signal. Since it also has the analogue signal, it is compatible with conventional installations. HART standard helps instruments to digitally communicate with one another over the same two wires used to convey a 4-20 ma analog instrument signal.

SMART = Single Modular Auto-ranging Remote Transducer.
SMART instruments can be HART,FF or Profibus.
SMART transmitters compared to analog transmitters have microprocessor as their integral part , which helps for self diagnostic abilities , non-linear compensations , re-ranging without performing calibrations and ability to communicate digitally over the network

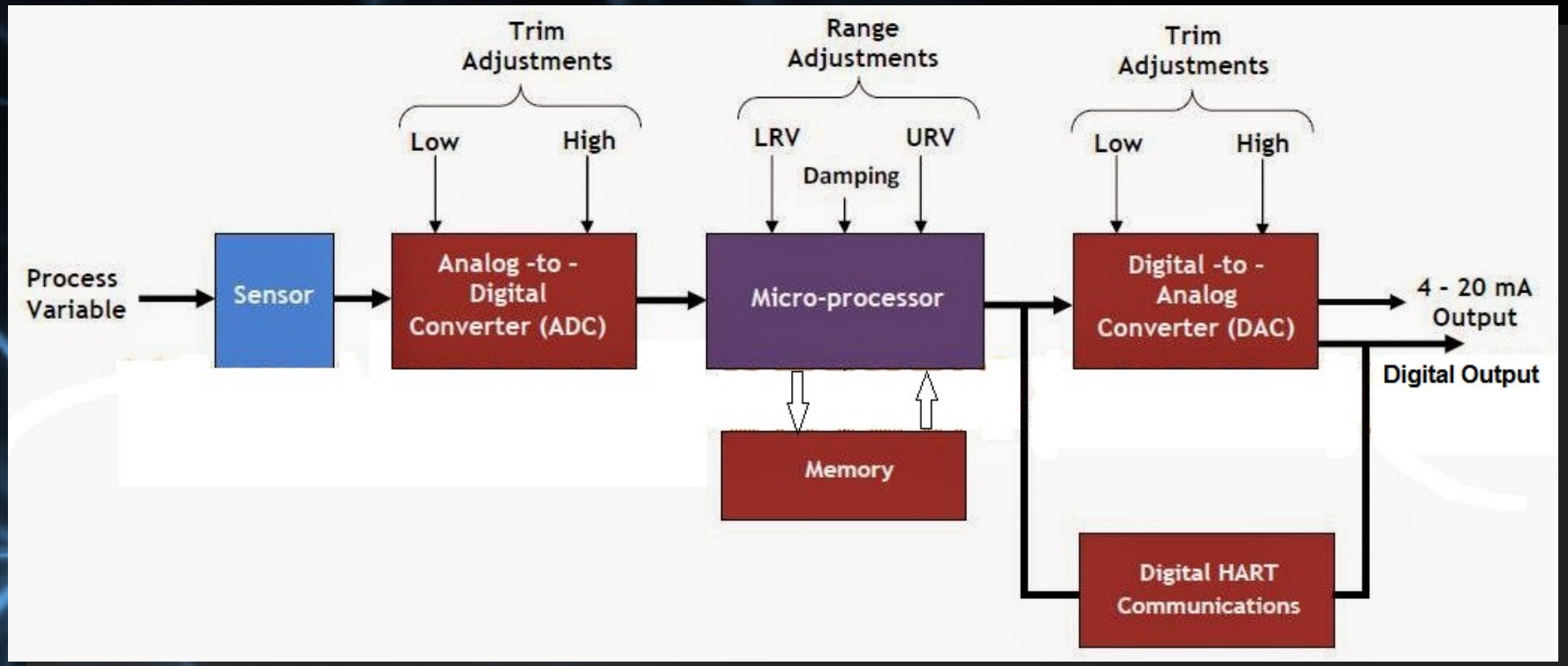
What is a ‘Smart’ Transmitter?

A microprocessor-based smart transmitter has a memory that can perform calculations, produce diagnostics and out-perform older, more conventional transmitters, when it comes to accuracy and stability.

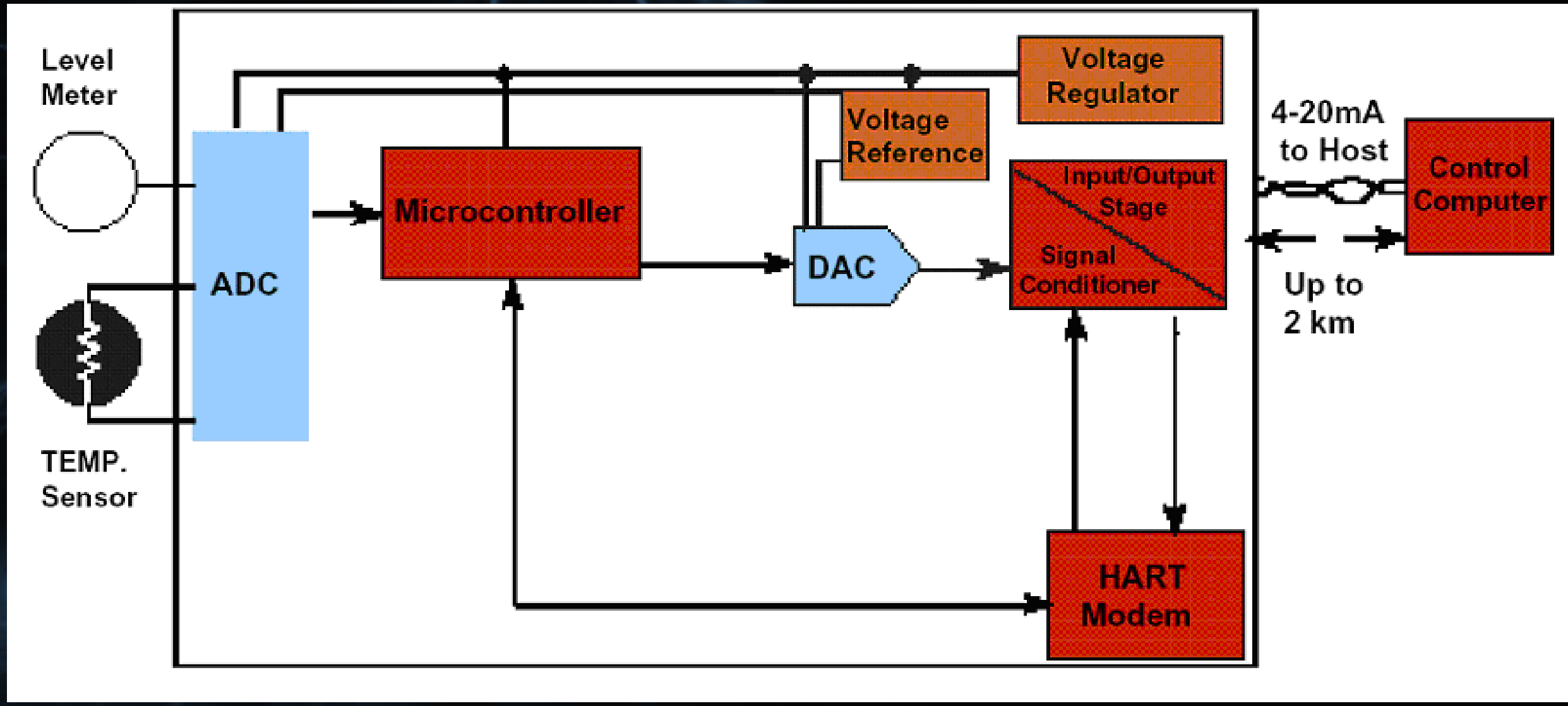
A ‘Smart’ Transmitter would also have a digital communication protocol that can be used for reading the transmitter’s measurement values and for configuring various settings in the transmitter.

For engineer’s who need to configure and calibrate the transmitter, the digital communication protocol makes the biggest difference. Engineers can no longer simply measure the output analogue signal – they need to be able to communicate with the transmitter and read the digital signal

Smart Transmitter



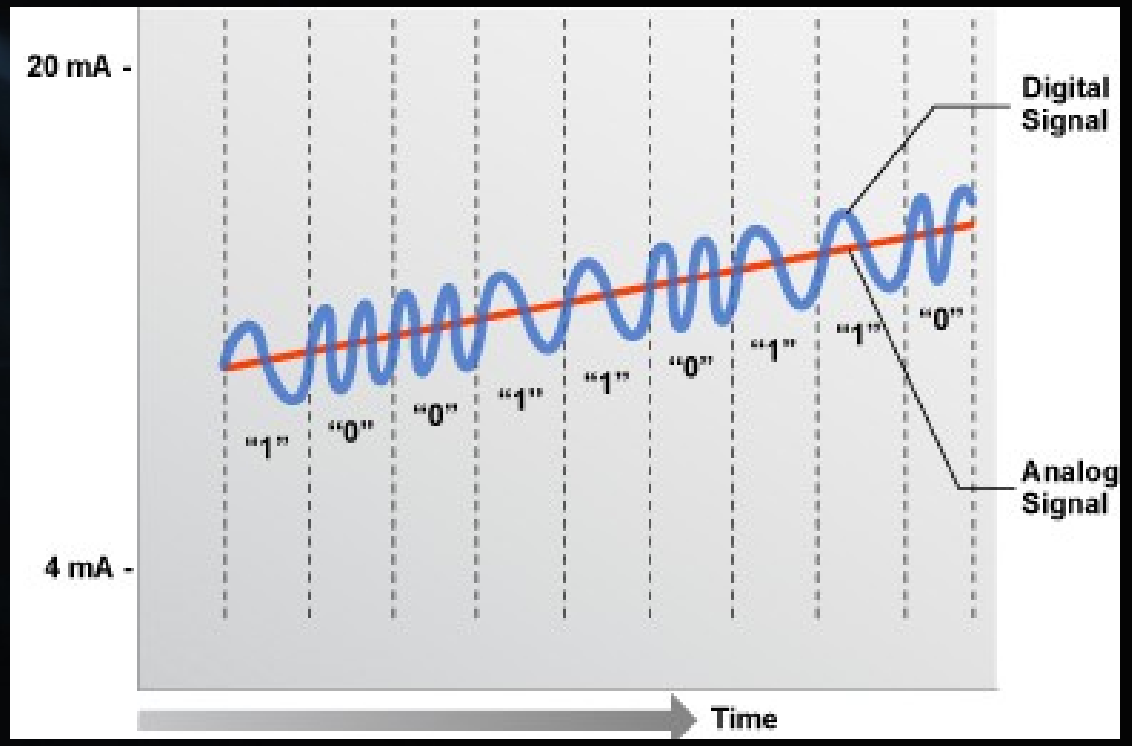
HART Transmitter

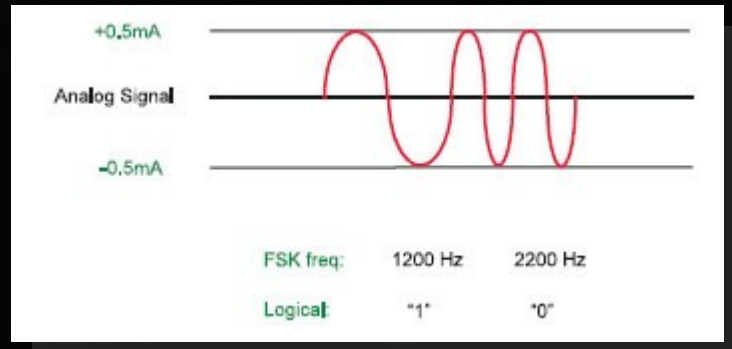


How HART Transmitter Works

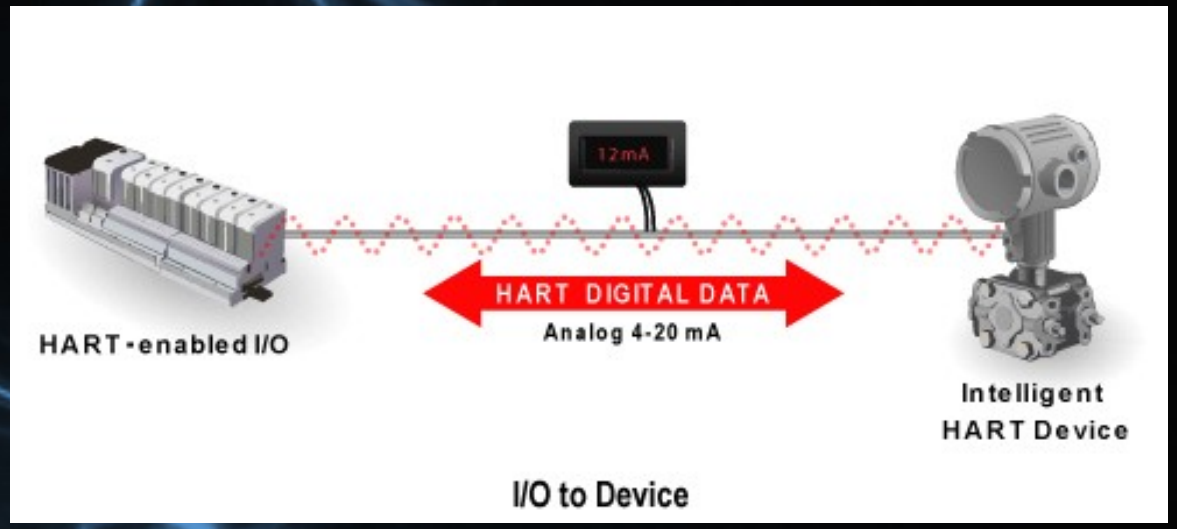
The HART Protocol makes use of the Bell 202 Frequency Shift Keying (FSK) standard to superimpose digital communication signals at a low level on top of the 4-20mA. This enables two-way field communication to take place and makes it possible for additional information beyond just the normal process variable to be communicated to/from a smart field instrument.

The HART Protocol communicates at 1200 bps without interrupting the 4-20mA signal and allows a host application (master) to get two or more digital updates per second from a smart field device. As the digital FSK signal is phase continuous, there is no interference with the 4-20mA signal.



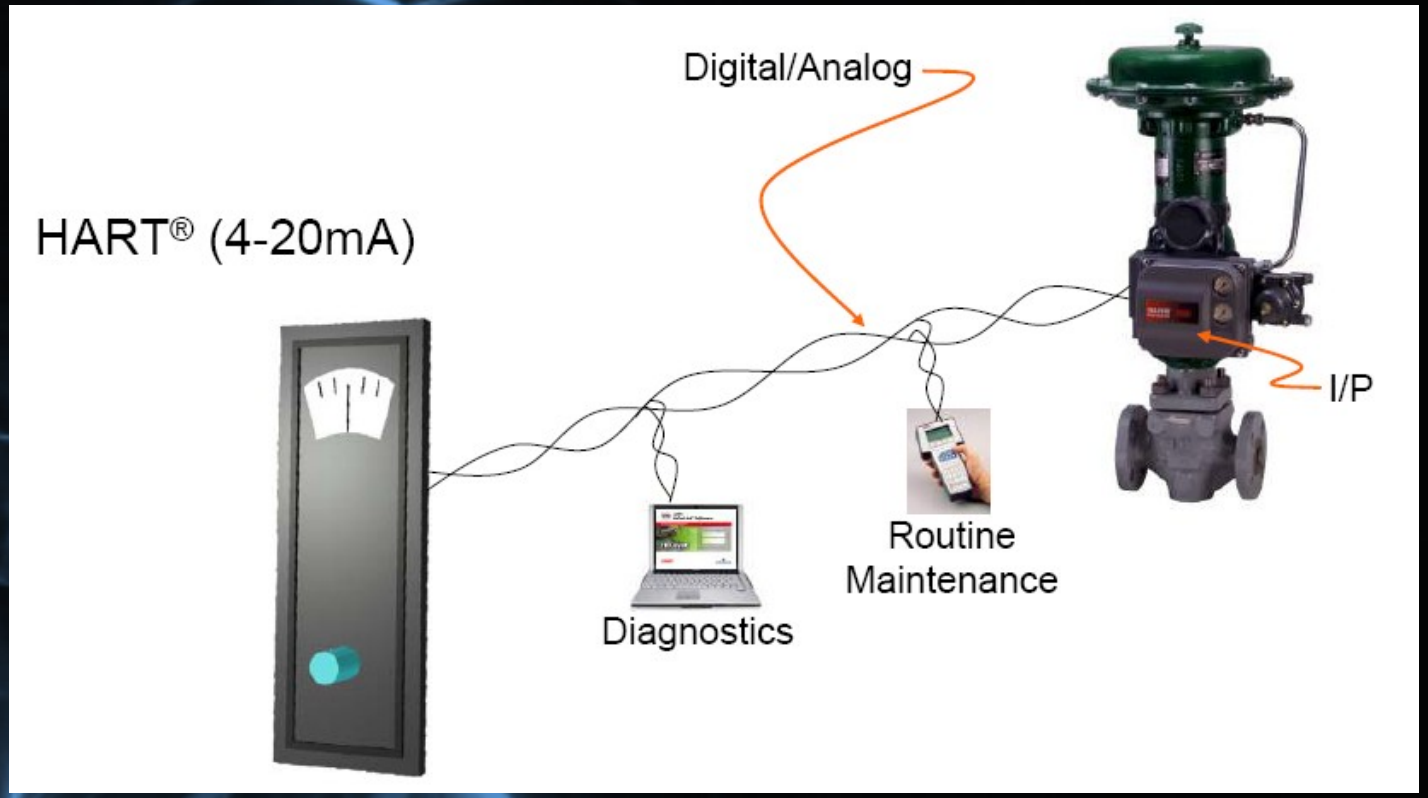


Two Communication Channels



The HART Protocol provides two simultaneous communication channels: the 4-20mA analog signal and a digital signal. The 4-20mA signal communicates the primary measured value (in the case of a field instrument) using the 4-20mA current loop - the fastest and most reliable industry standard. Additional device information is communicated using a digital signal that is superimposed on the analog signal.

The digital signal contains information from the device including device status, diagnostics, additional measured or calculated values, etc. Together, the two communication channels provide a low-cost and very robust

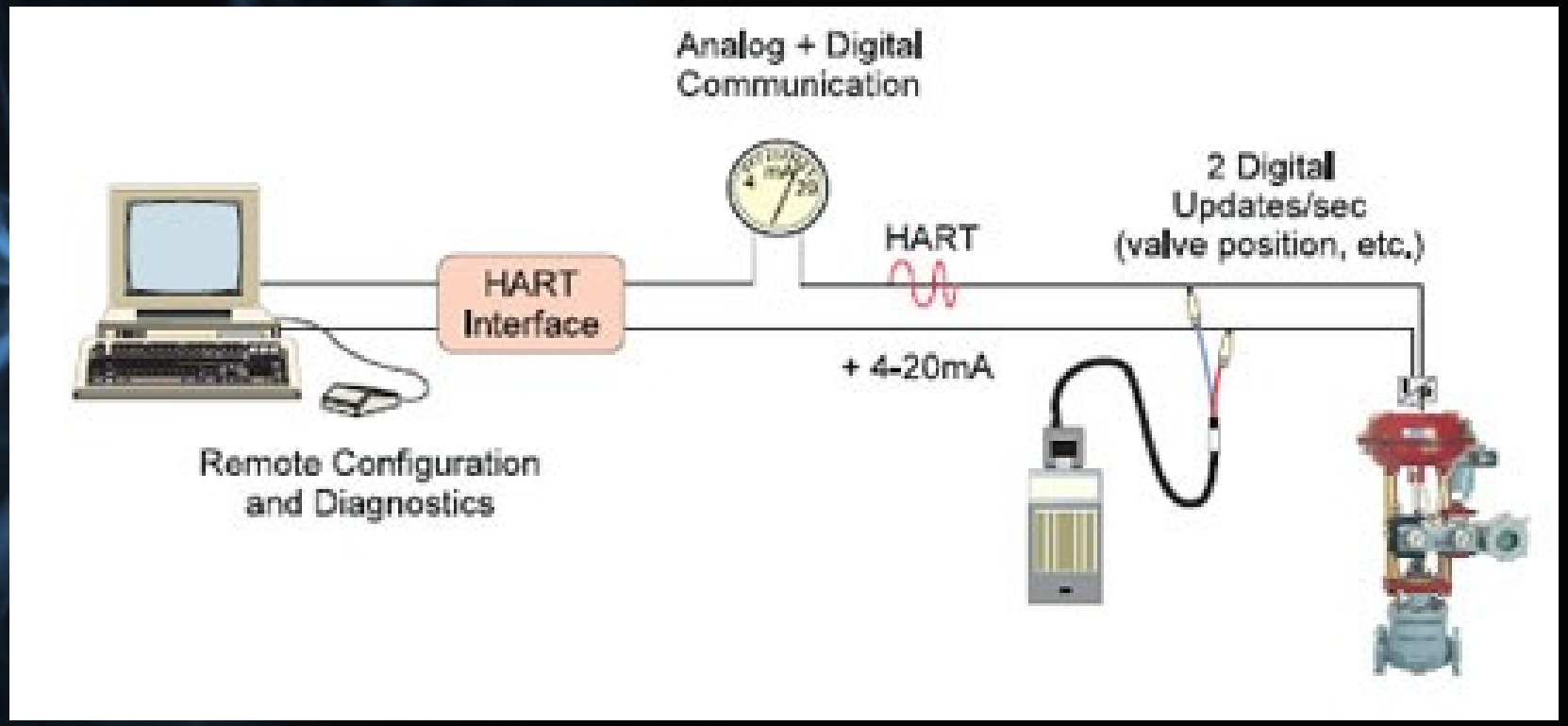


HART Communication Protocol has transformed advanced modernization in the field of Automation.

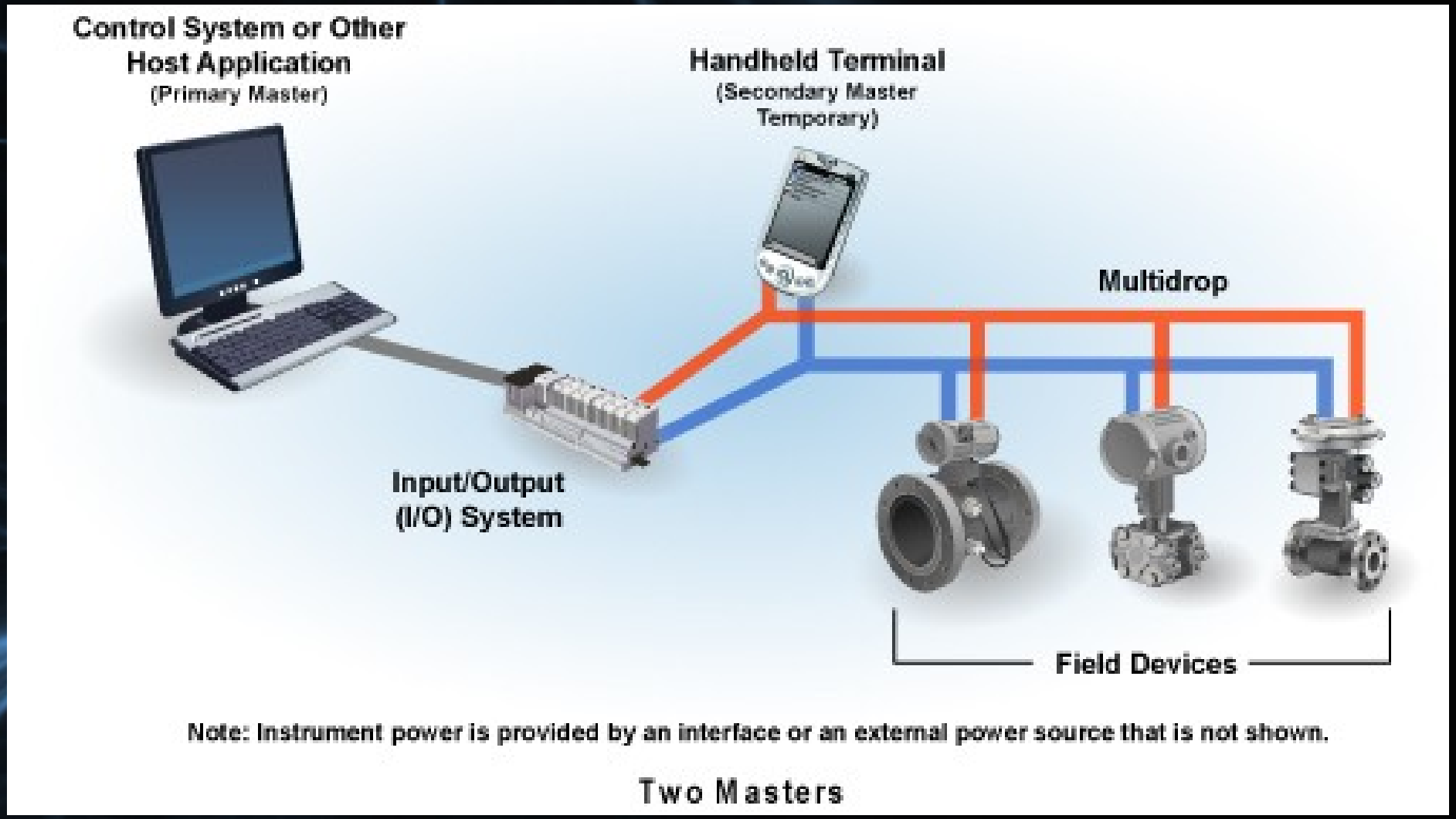
- **Same transmitter can be used for various range by changing LRV /URV.**
- **Spare part management has become easier. Any maker with HART protocol can be used.**
- **Can be calibrated from control station.**
- **Can be used in Hazardous area .**

Primary and Secondary Masters

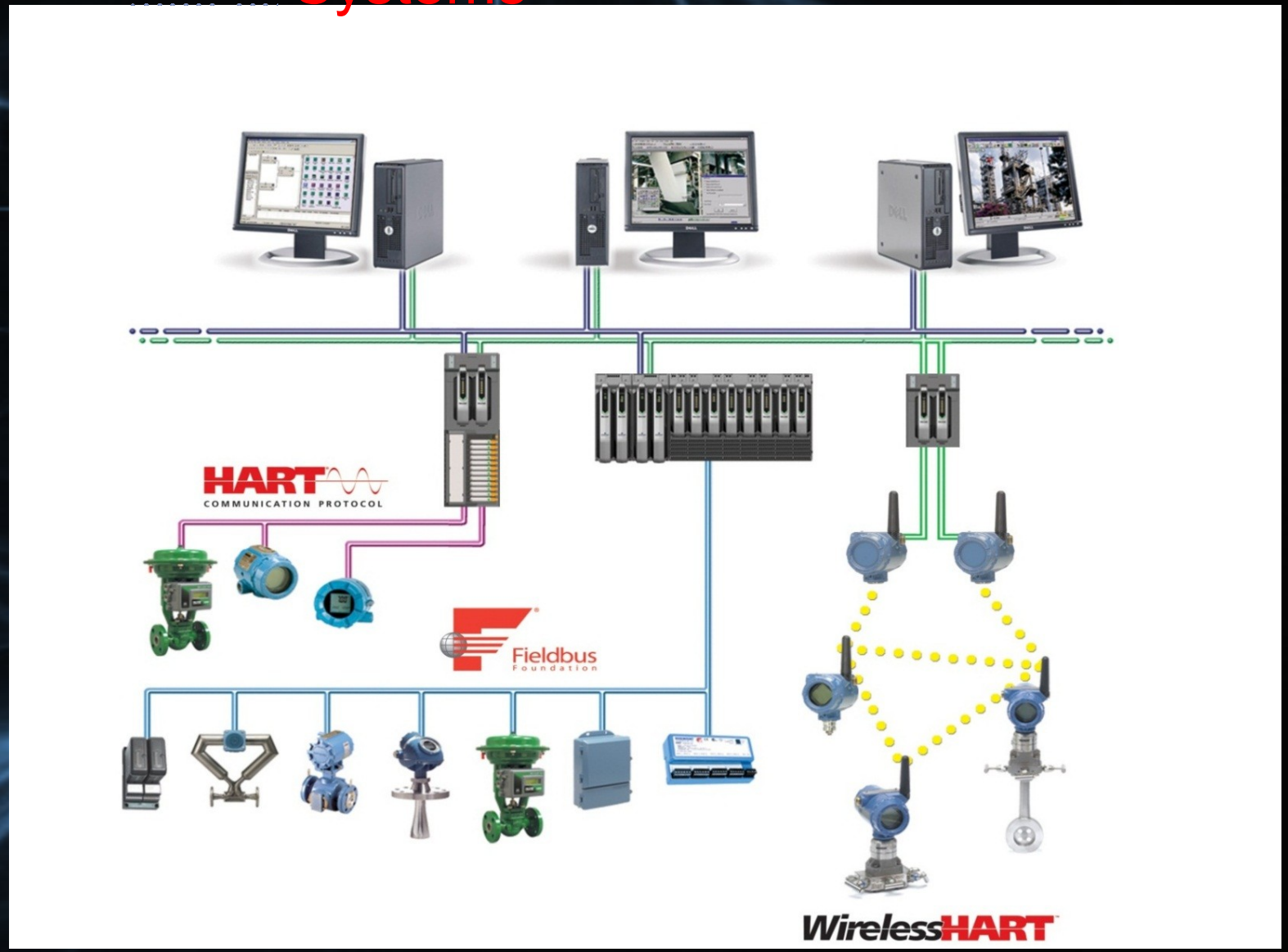
The HART Protocol provides for up to two masters (primary and secondary). This allows secondary masters such as handheld communicators to be used without interfering with communications to/from the primary master, i.e. control/monitoring



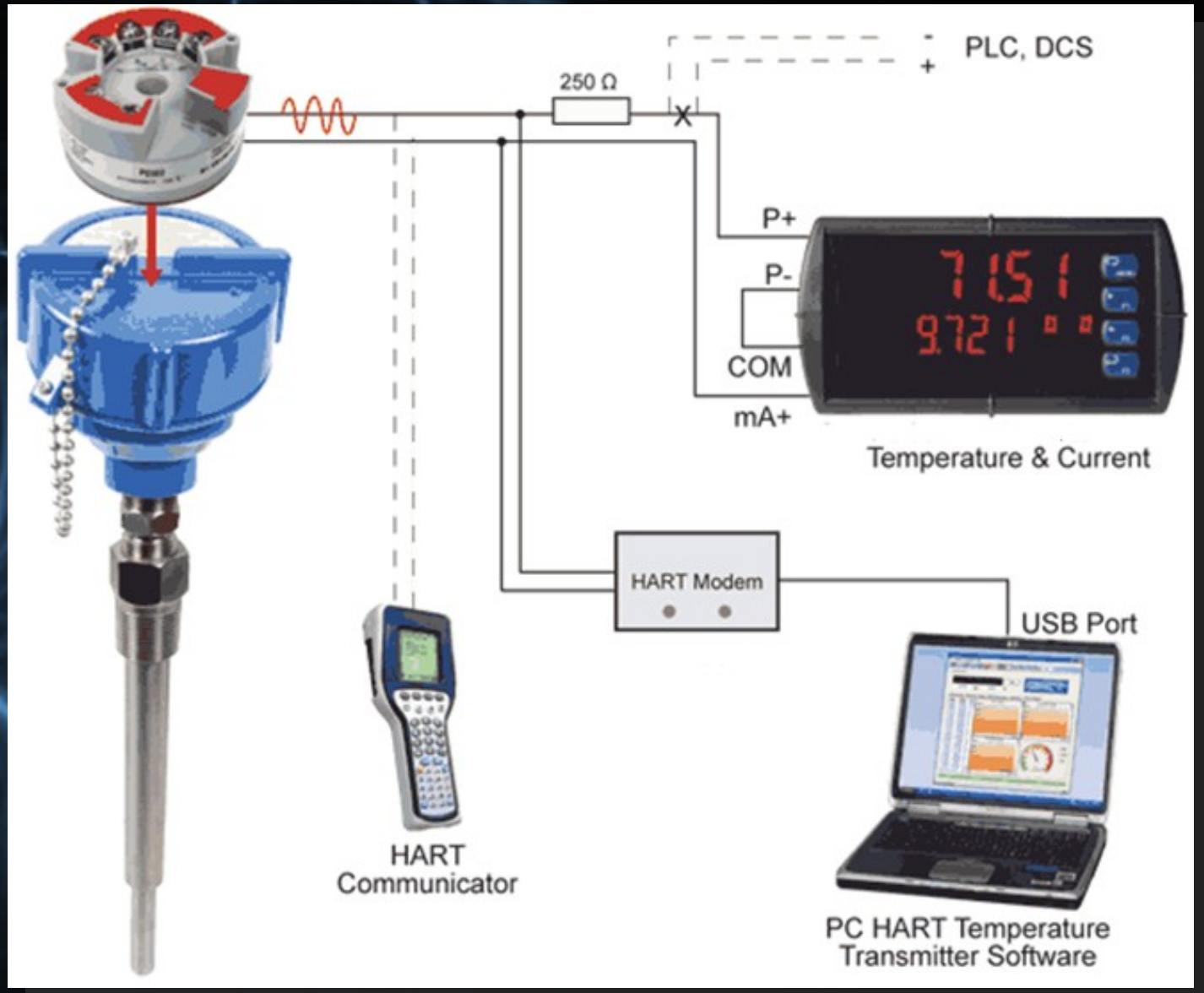
Multidrop Configuration



Wireless HART Protocol in Smart Instrumentation Systems



HART Protocol in Smart Instrumentation Systems



Is calibration of Smart Transmitter important?

Although a ‘Smart’ Transmitter is advertised as being smart and extremely accurate, there is still a need to calibrate the instruments.

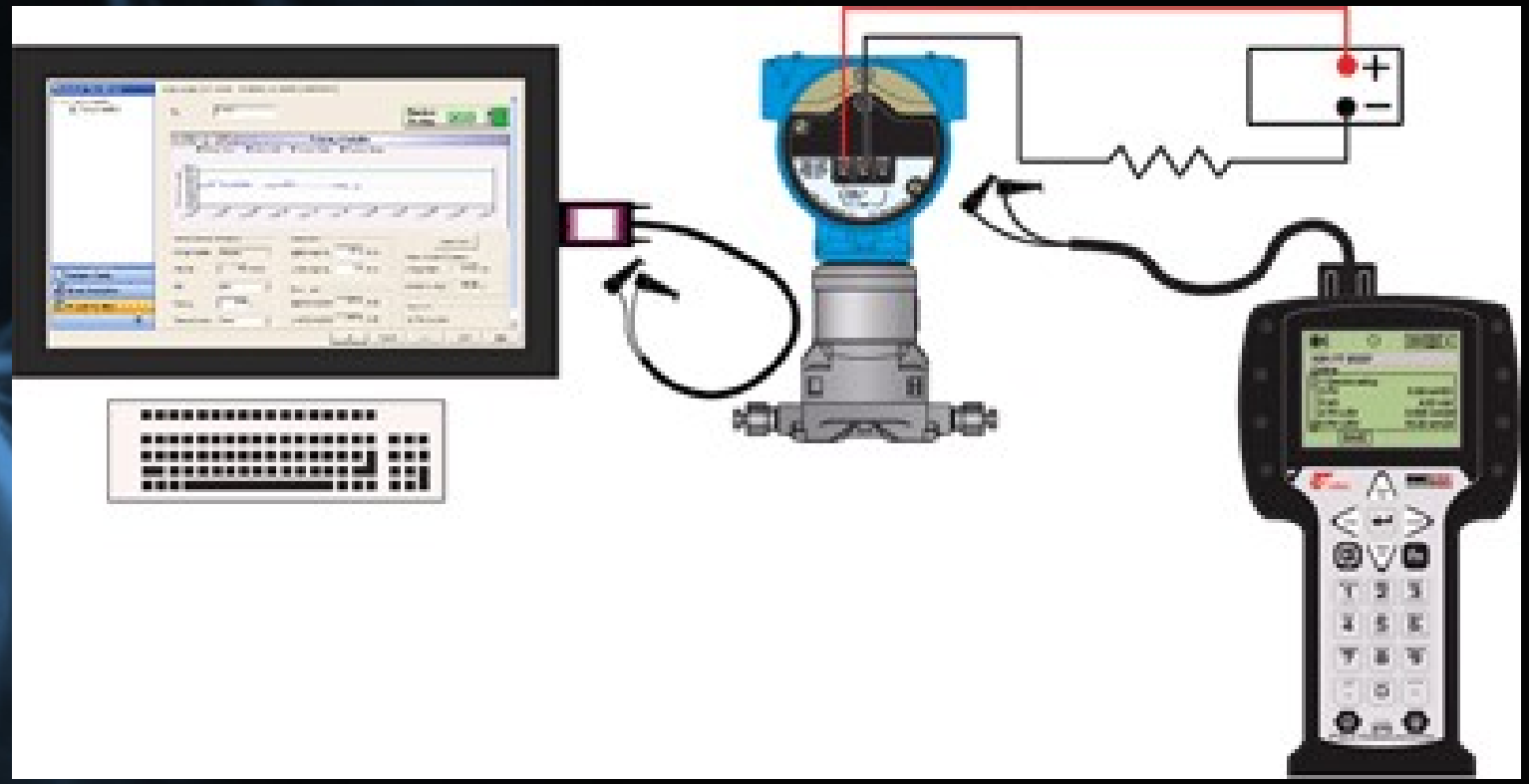
Calibration must always be a priority due to the following reasons:

- Even the best instruments and sensors drift over time, especially when used in challenging process applications.
- Regulatory and quality standards often state the minimum time period for instrument calibration.
- Economical reasons – measurement of process parameters often has a direct economical effect .

Calibration is necessary to achieve high and consistent

Calibrator is for maintaining and troubleshooting HART instrumentation

USB HART Modem



Why Need 250 ohms resistor in HART protocol

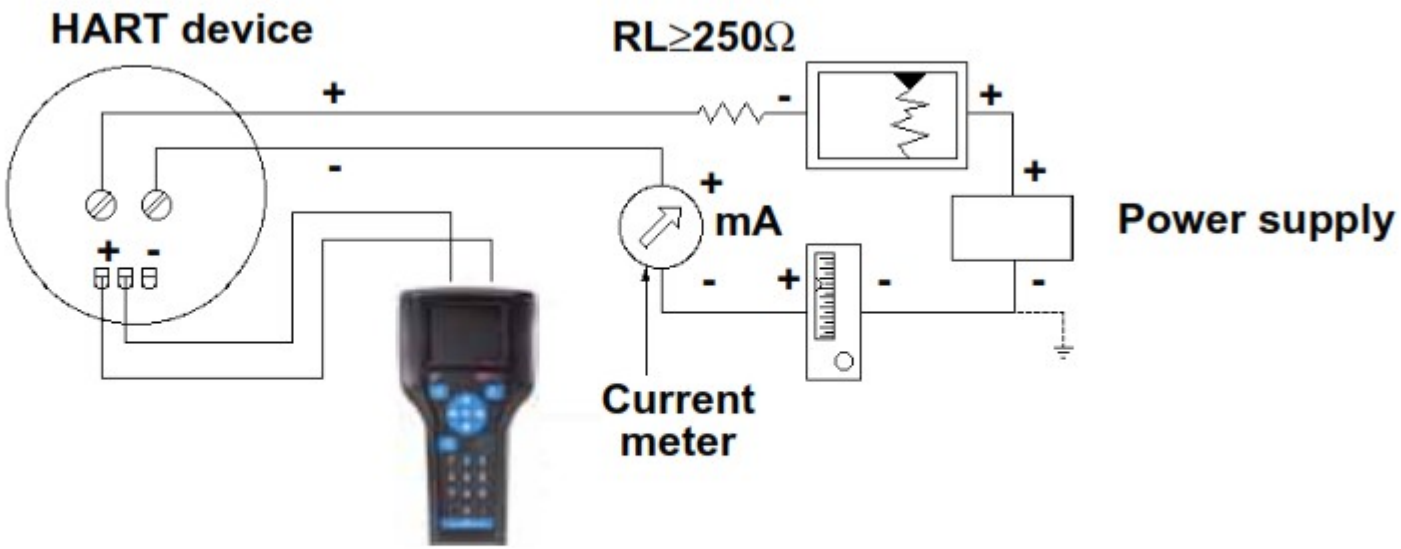
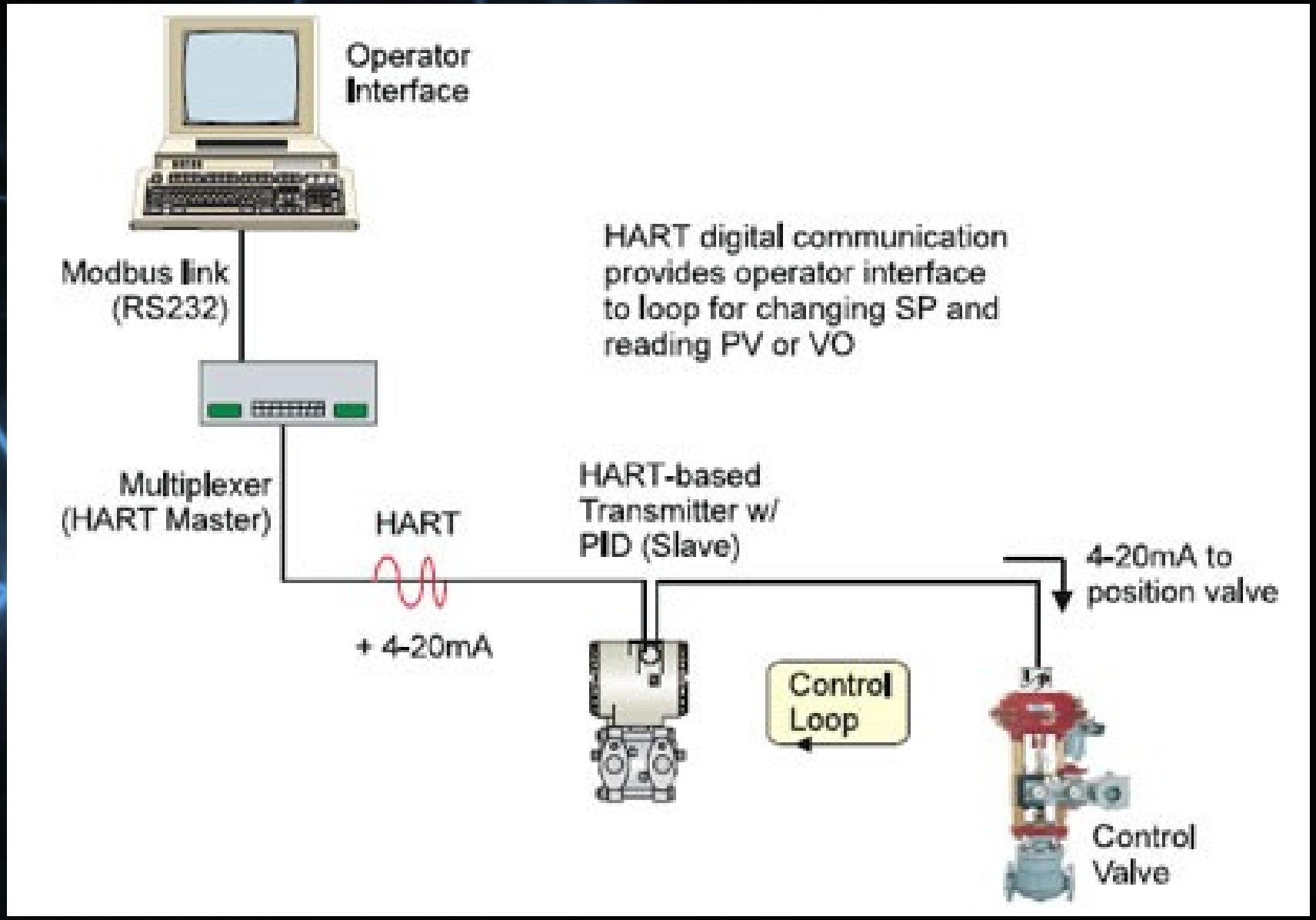
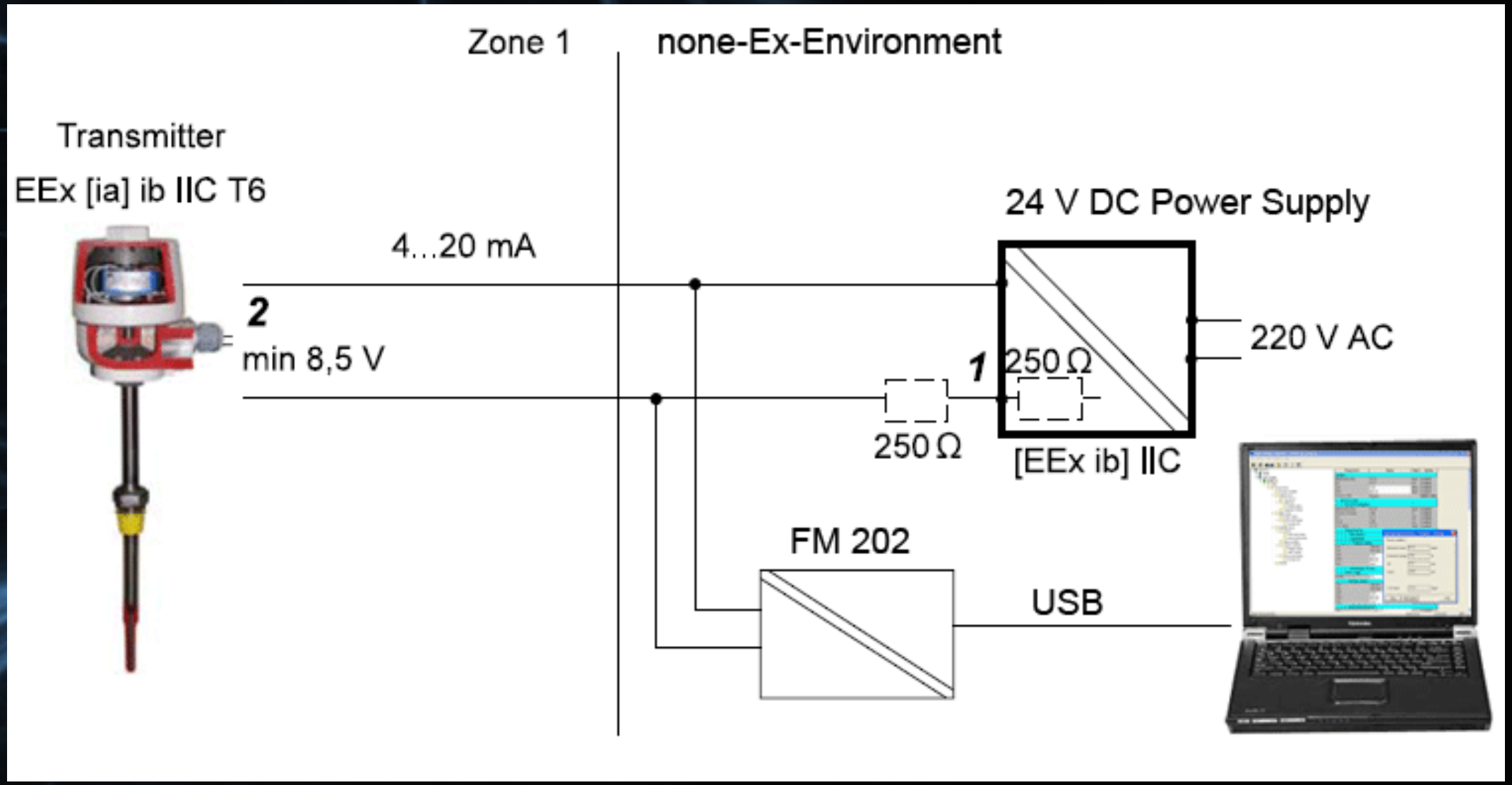


Figure 3-5 shows how to connect the optional 250 ohm resistor. Attaching a resistor is necessary if less than 250 ohms resistance is present in the HART loop.

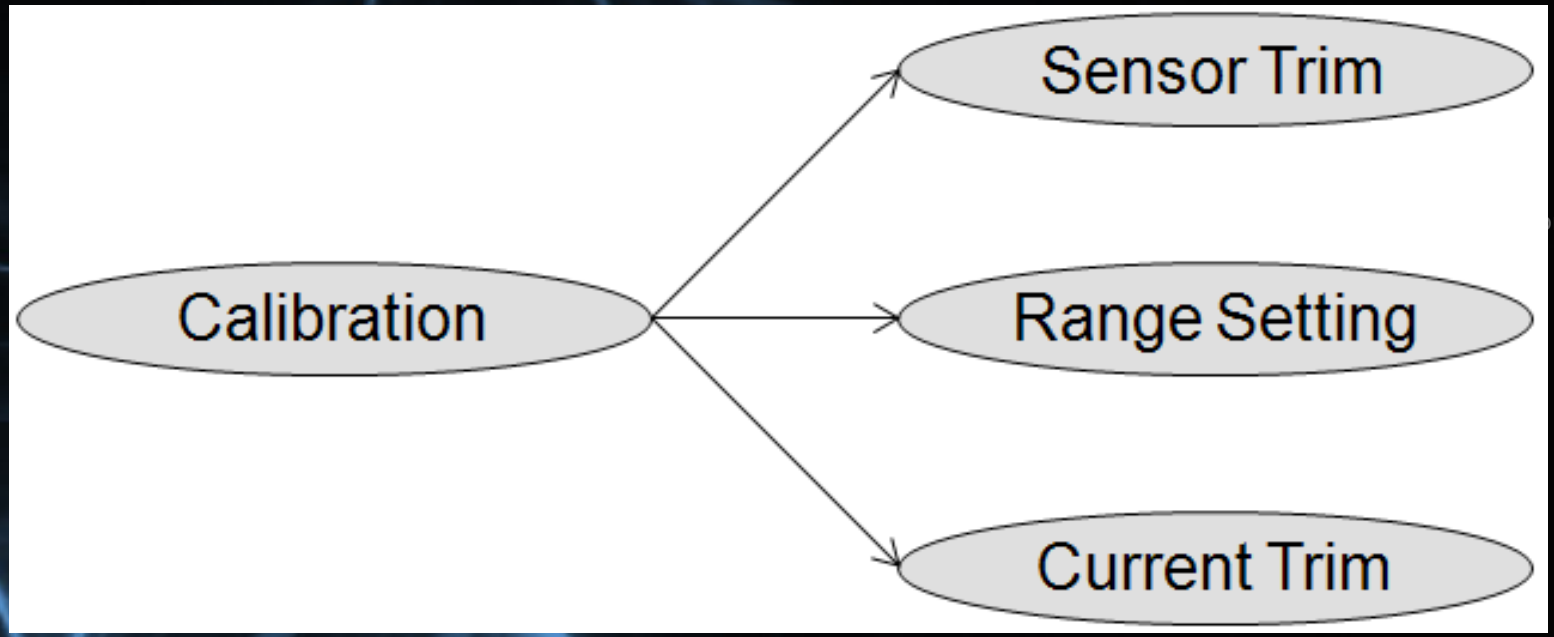
HART-based instruments include PID algorithms for implementing cost effective control



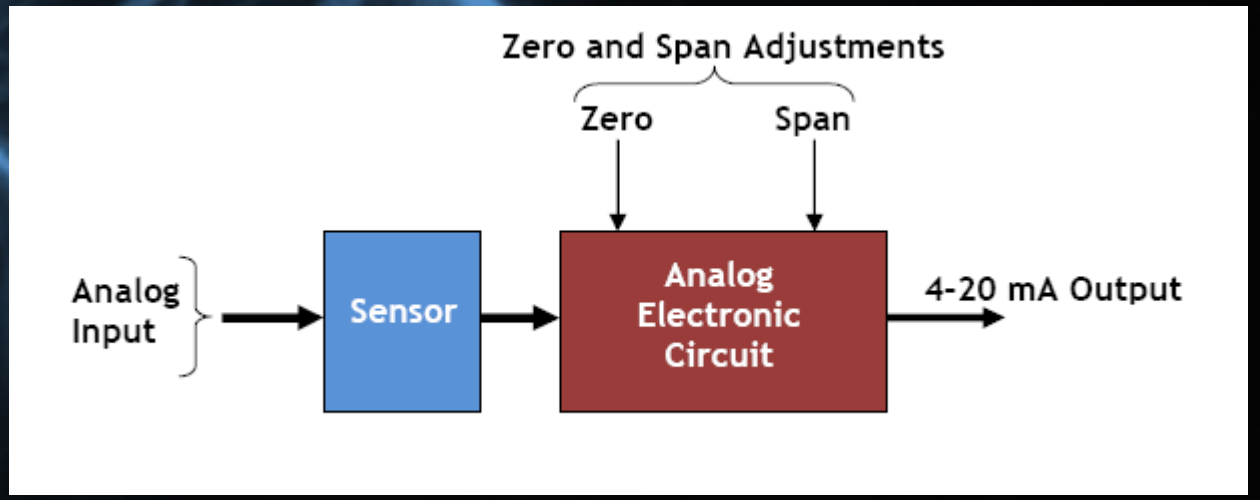
HART TRANSMITTER IN Ex Zone



What is calibration?

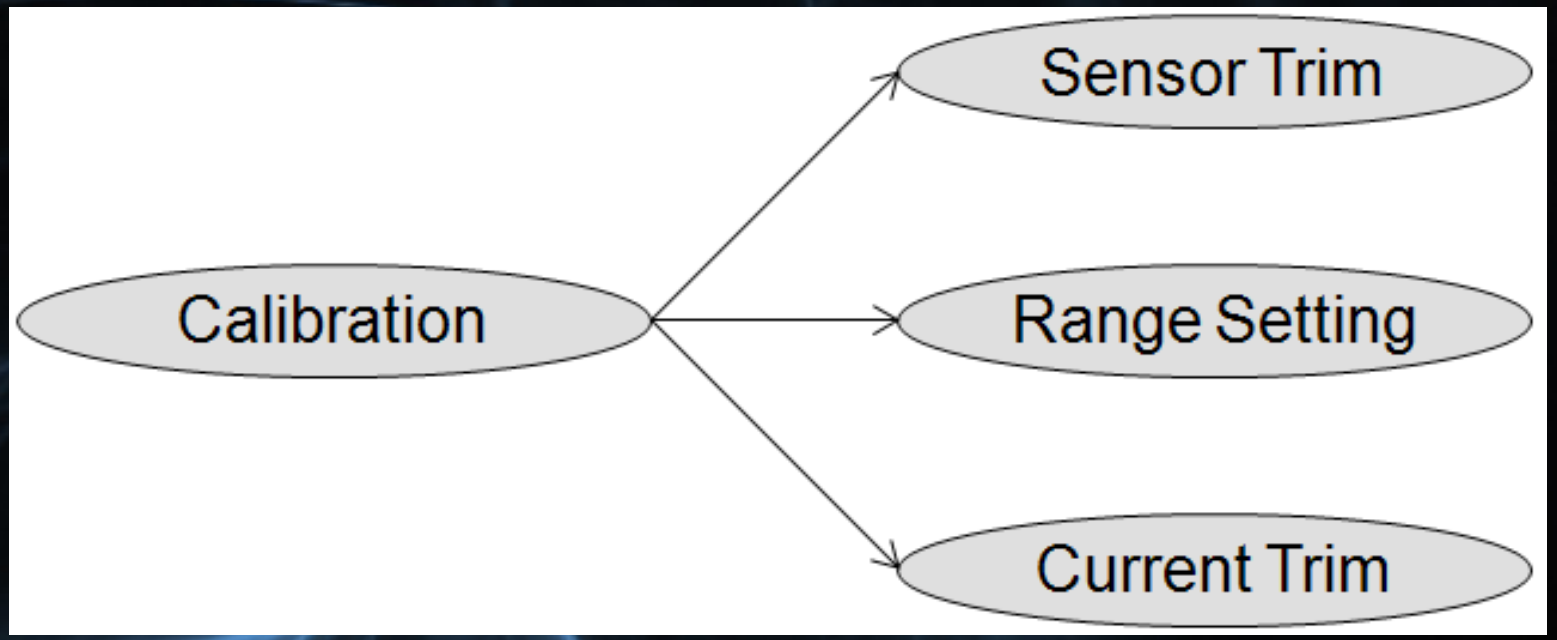


r trim, range setting (re-ranging), or current tr



What is calibration?

Sensor trim is the correction of the digital reading from the sensor after the A/D conversion.



Re-ranging is configuration of the lower and upper range values corresponding to the input values at which the transmitter output shall be 4 mA and 20 mA respectively.

Current trim is the correction of the analog output from the transmitter

HART Calibration is Required!

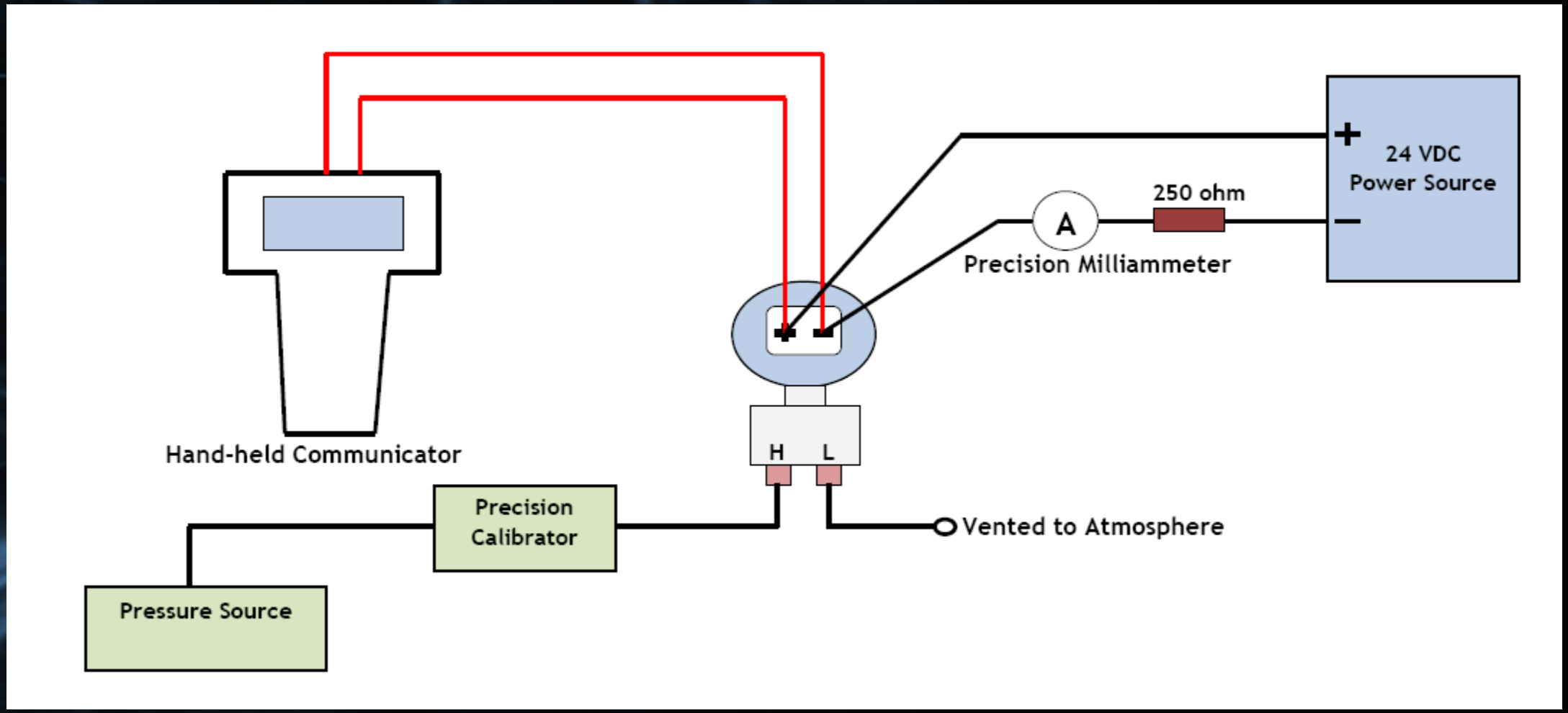
A common misconception is that the accuracy and stability of HART instruments eliminate the need for calibration.

Another misconception is that calibration
can be accomplished by reranging field instruments using only a HART communicator.

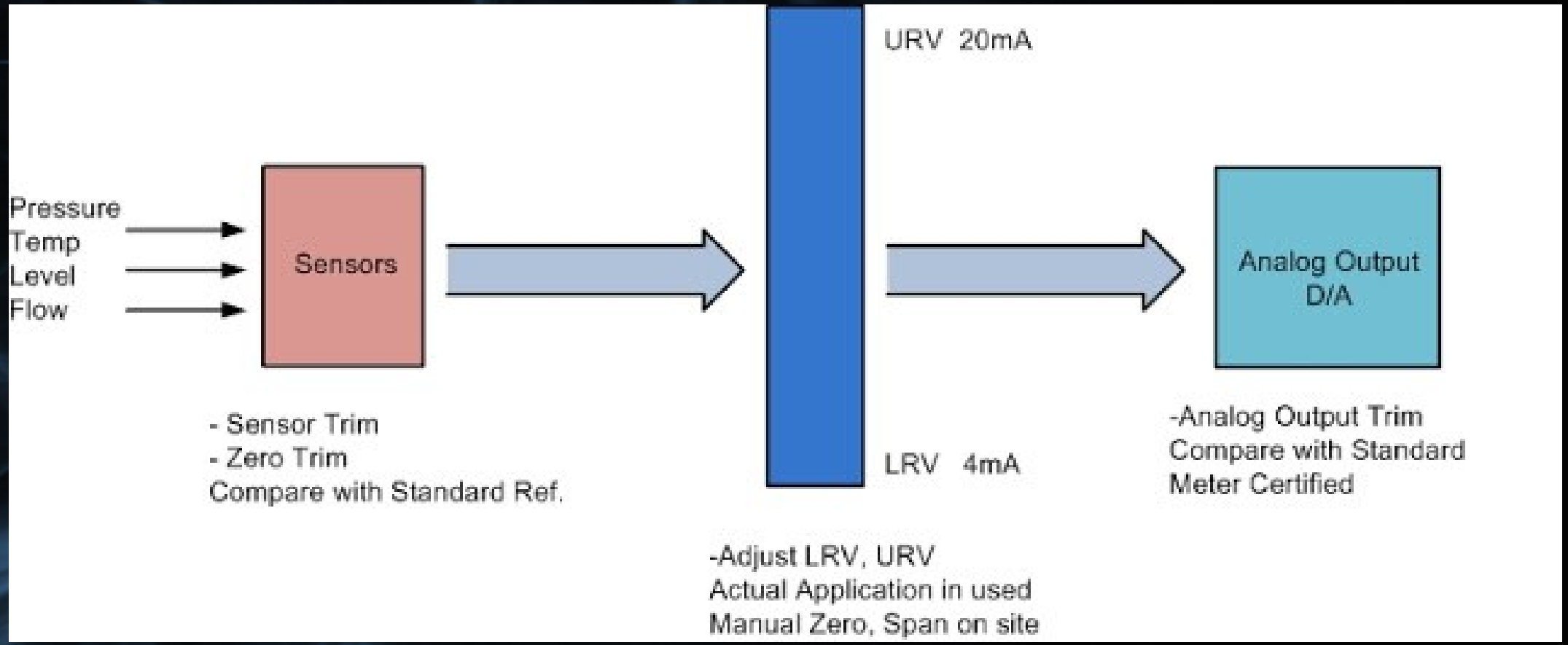
Still another misconception is that the control system can remotely calibrate smart instruments

All instruments electronic components drift. Re-ranging with just a communicator is not calibration

Calibration



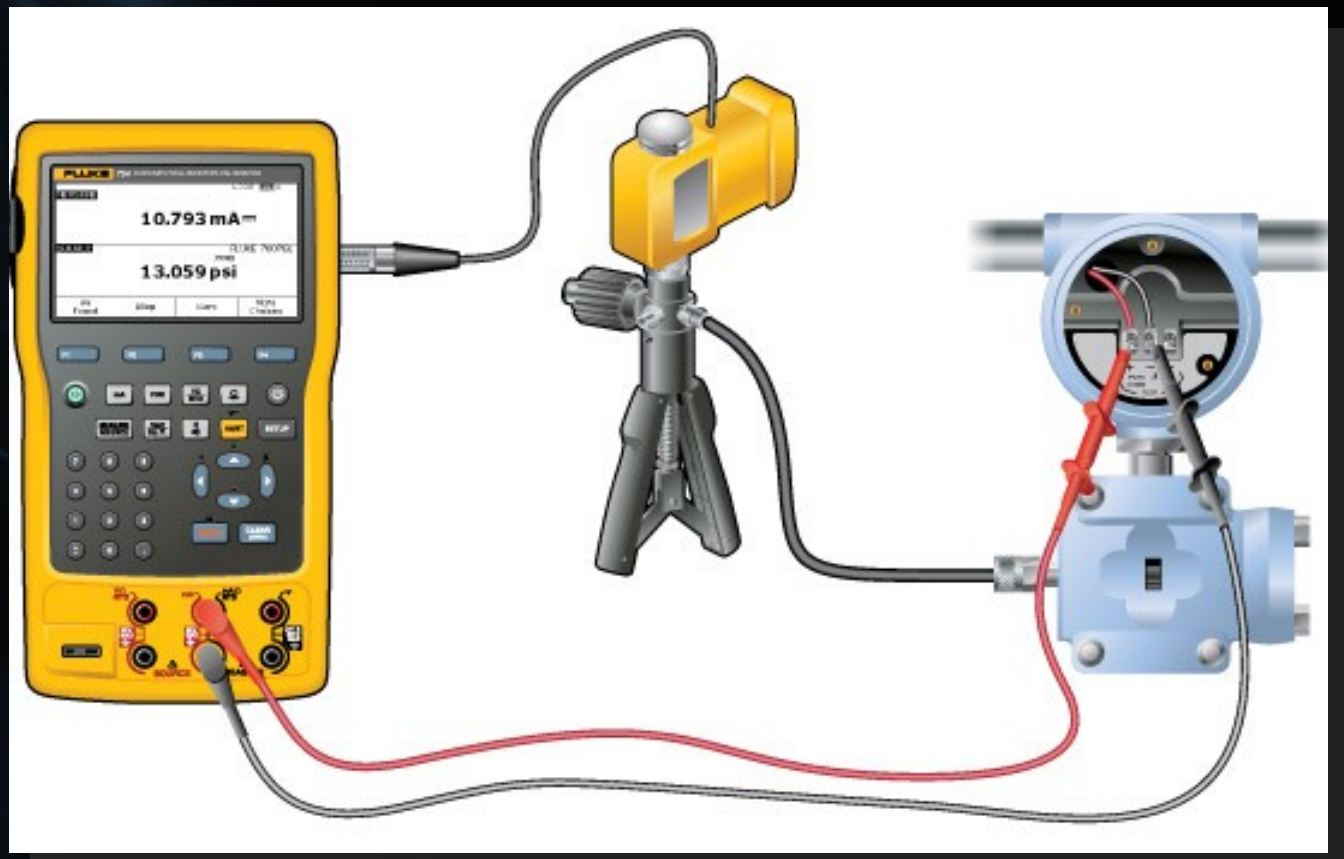
HART Transmitter Calibration

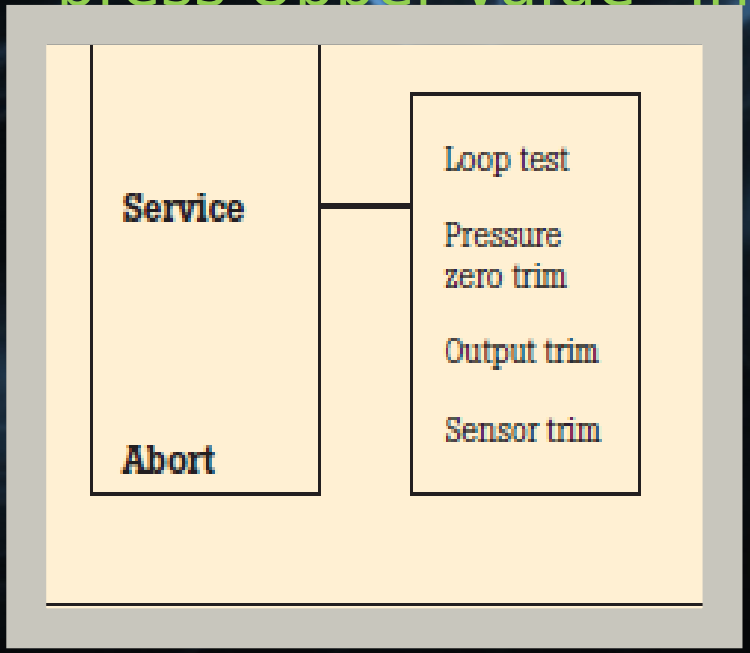


Calibration of a HART Pressure Transmitter

Press the Adjust soft key apply no pressure . Select Sensor Lower Trim value Trim and execute Lower Trim value trim.

Apply the URV pressure, press Upper value Trim.





HART Transmitter Calibration

Analog D/A Trim

You can adjust the Analog out put of transmitter by comparing with the standard meter for make sure that the digital value of processing same with the Analog output value.

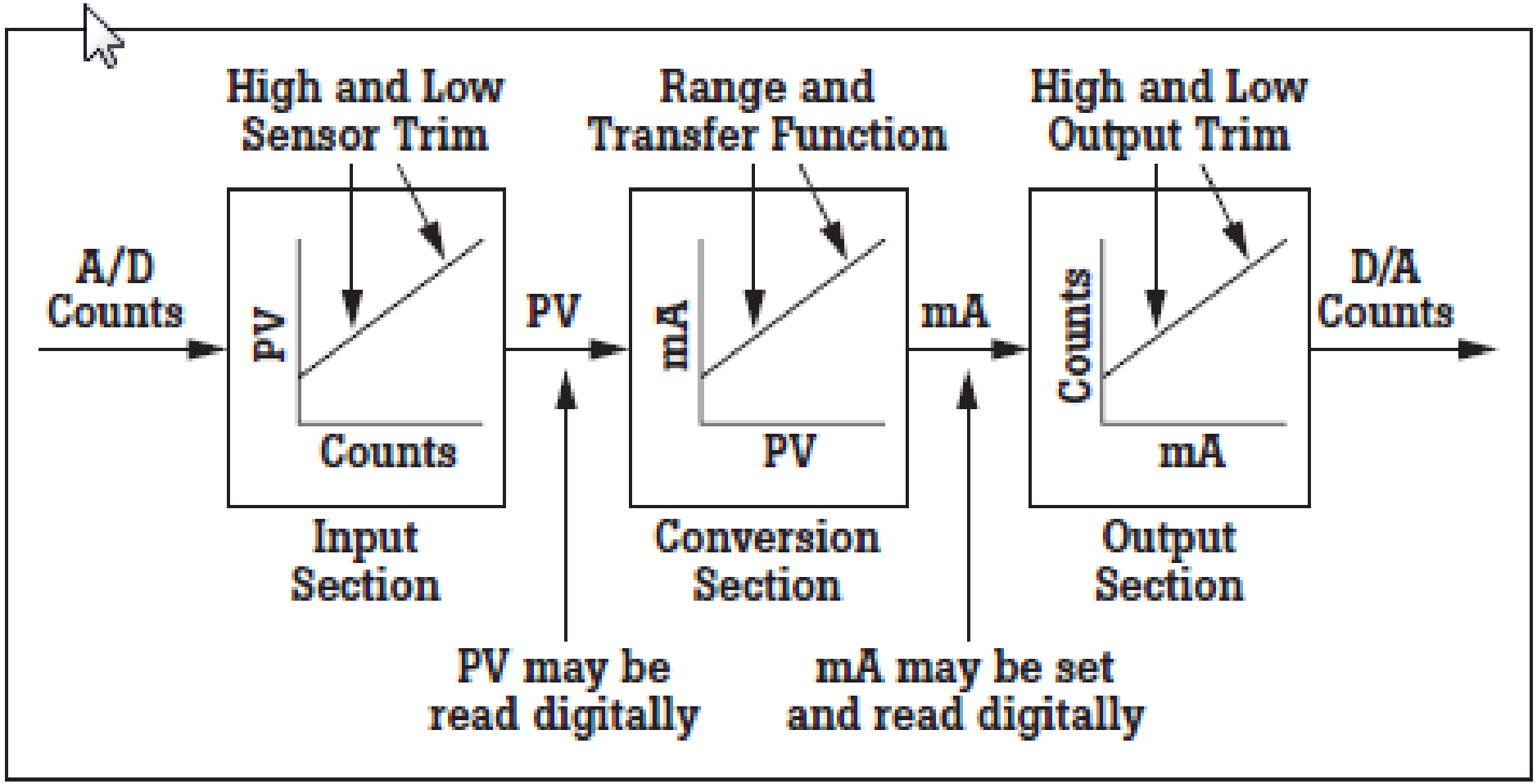
HART Transmitter Calibration

For best results, press LRV to apply the LRV for the Lower Trim value. Press Trim and
then Continue to move to the Upper Trim. Press URV, press Trim, and then press Done. Select Output Trim and press .

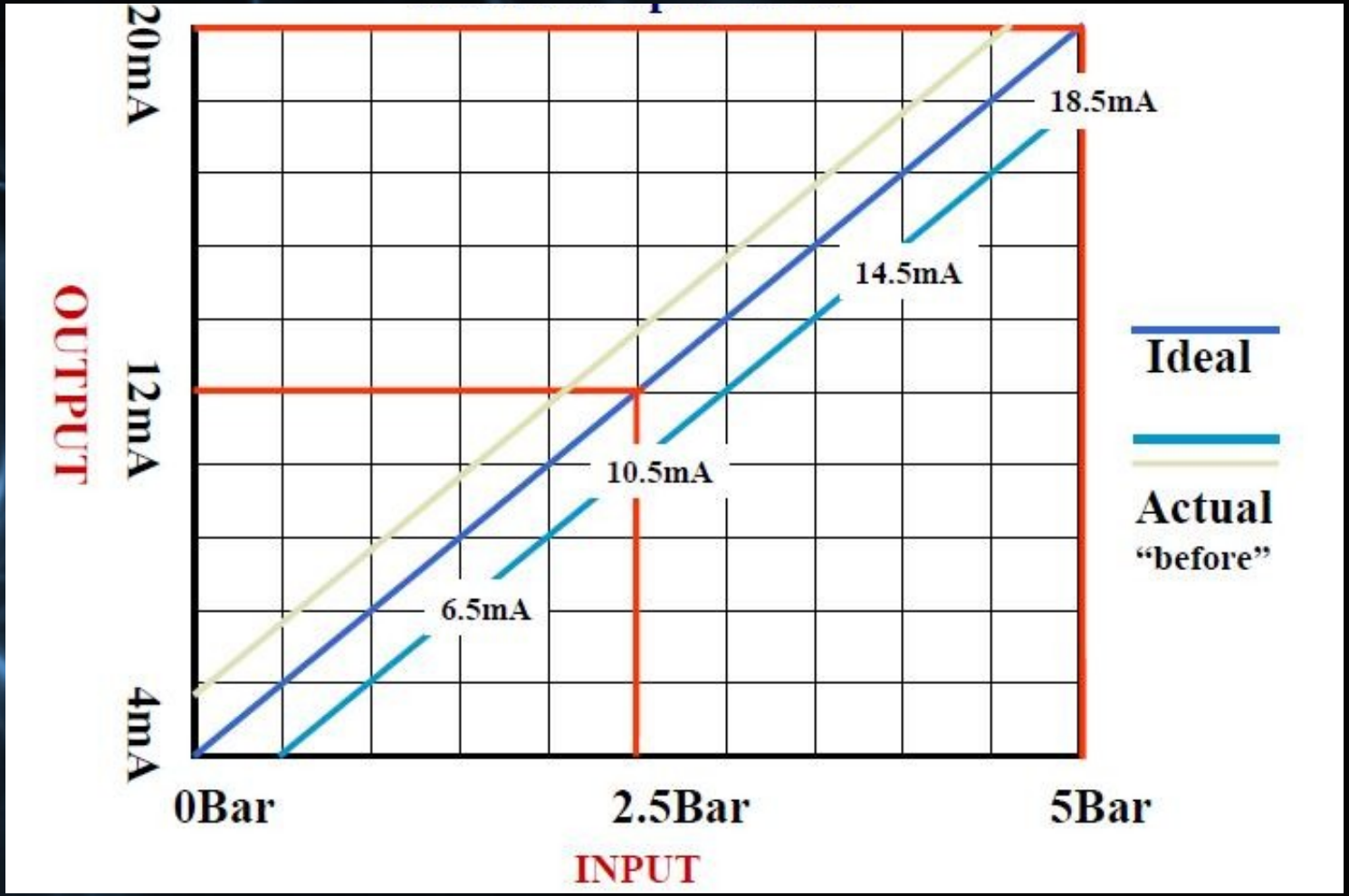
Select Output Trim and
press .
This is normally a 4 mA signal. The mA value, as constantly measured by the mAmp metrer
is in the center of the display. Press the Fetch softkey to load the measured mA value. Press Send to *send* the value to the 3144 to trim the output section for the 4 mA value.

Press Continue for the 20 mA trim and repeat this step.

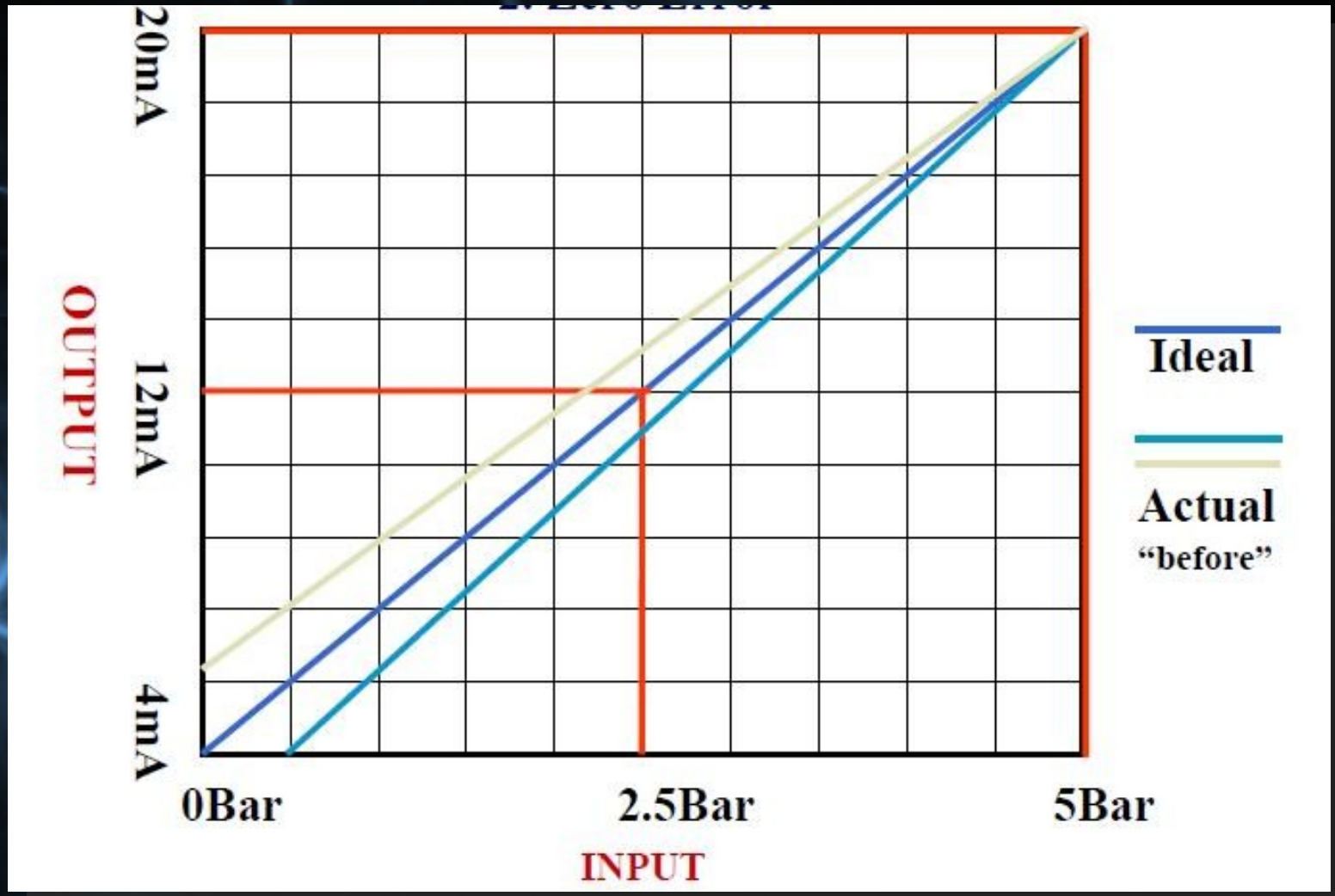
HART Transmitter Calibration



ZERO ERROR (Constant all over the Range)

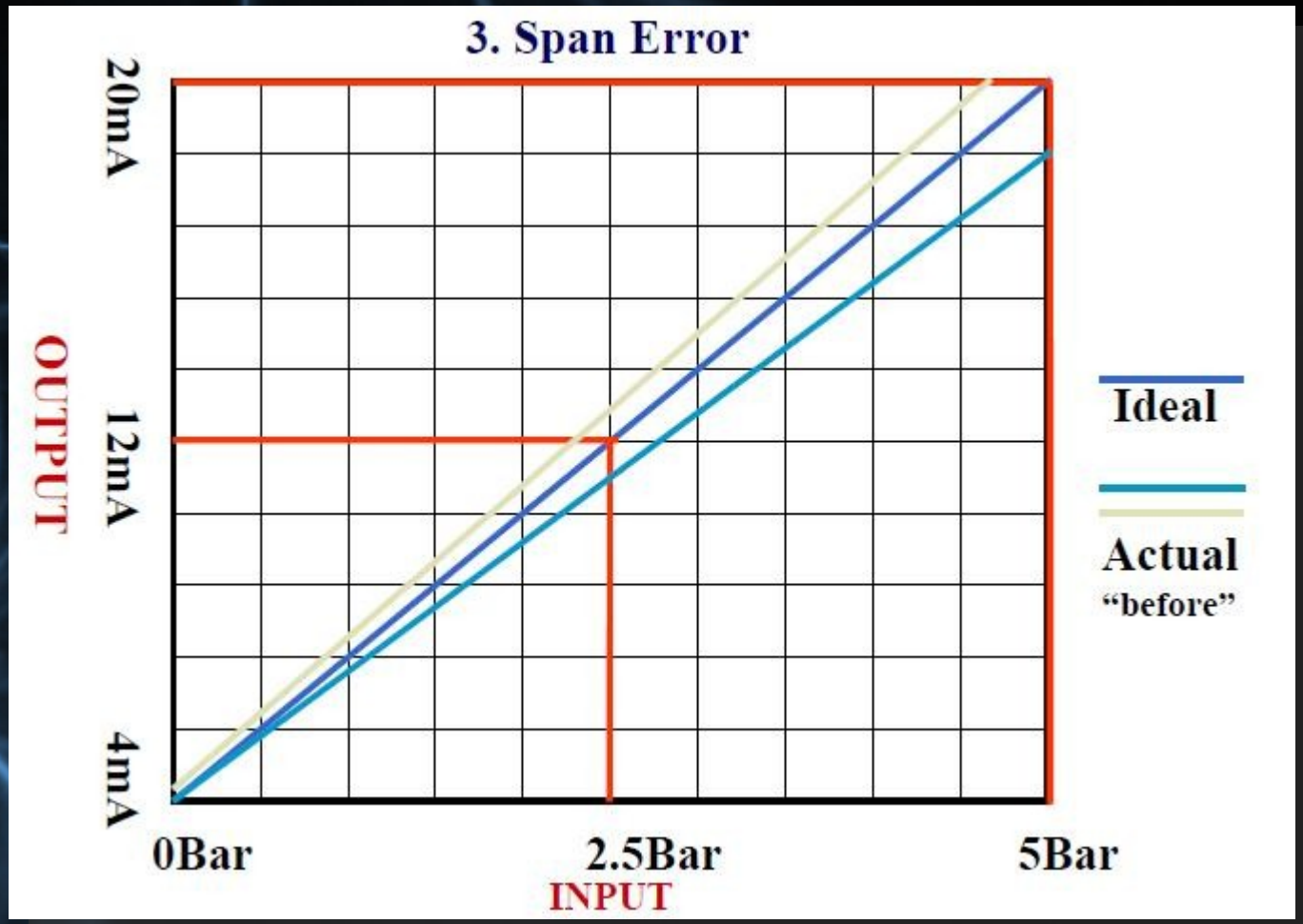


Span is correct but Zero Error



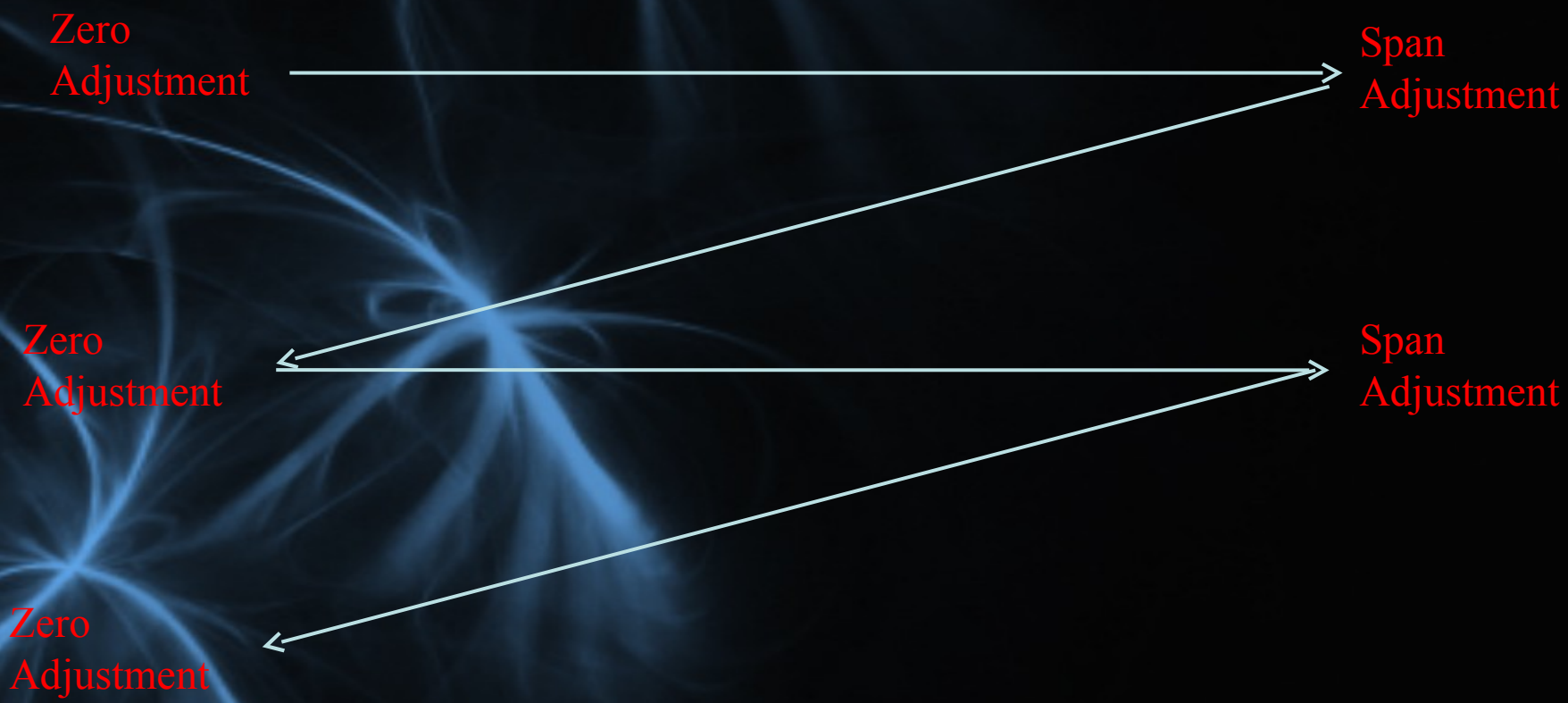
Zero Shift will change the whole scale identical value (Uniform

SPAN ERROR



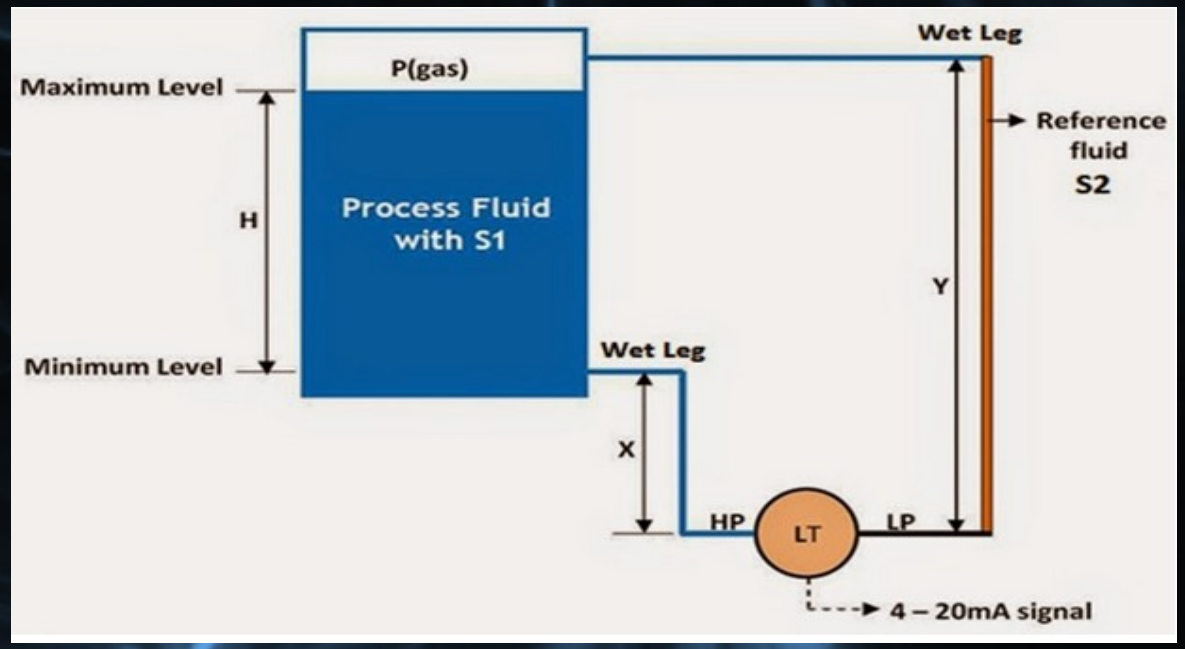
Span shift will have different value throughout the scale

Zero & Span Calibration



Correct Procedure to adjust zero and span adjustment

Adjustment of Boiler wtr Level Smart DP Tx.



This calculation used for closed tank level measurement with wet leg type calibration

Enter the required information

Tank Height (H)	1000
Distance between transmitter & HP tapping point (X)	300
Wet leg Height (Y)	1300
Process fluid specific gravity (S1)	1
Wet Leg Liquid Specific Gravity (S2)	1

The Calculated Instrument range is

HP Side or LRV or 4ma value or 0%	-1000	X - Y
LP Side or URV or 20ma value or 100%	0	(H+X) - Y
Span	1000	

Zero Elevation and Zero Suspressoin cane be adjusted by making adjustment in LRV and URV