4–20 mA FIELD REFERENCE

Quick reference for controls and instrumentation technicians

Standard Linear 4–20 mA Reference

Current	Span	250 Ω	Typical Meaning
4 mA	0%	1 V	Lower Range Value (LRV)
8 mA	25%	2 V	25% of configured span
12 mA	50%	3 V	50% of configured span
16 mA	75%	4 V	75% of configured span
20 mA	100%	5 V	Upper Range Value (URV)

Linear Scaling

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Engineering Value = LRV + ((mA – 4) ÷ 16) × (URV – LRV)
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Example: A 0–100 PSI transmitter producing 12 mA = 50 PSI. Always use the transmitter's configured LRV and URV; 4 mA does not necessarily mean zero engineering units.

LRV / URV

LRV = Lower Range Value: process value represented by 4 mA.
URV = Upper Range Value: process value represented by 20 mA.
Span = URV – LRV.

250 Ω Conversion

A 250 Ω resistor converts the loop current to 1–5 V:
V = I × R
4 mA × 250 Ω = 1 V
20 mA × 250 Ω = 5 V

Loop Voltage / Burden

Every device and resistance in the loop consumes some voltage. Adding resistance increases the voltage required from the loop power supply. Verify the complete voltage budget before modifying a loop.

Current vs. Voltage

A 4–20 mA loop transmits information as current. Cable resistance causes a voltage drop, but the measured loop current should remain the primary signal value when troubleshooting a properly operating current loop.

Field Troubleshooting — Work Through the Signal Path

1. **Verify transmitter configuration.** Confirm LRV, URV, engineering units, and signal mode.
2. **Measure loop current.** Measure the actual mA signal using the correct meter method for the loop and meter.
3. **Check loop power.** Verify supply voltage and available voltage after device and wiring burden.
4. **Check wiring.** Inspect terminals, polarity, connections, added resistance, and damaged conductors.
5. **Check the analog input.** Confirm the input is configured for the expected 4–20 mA signal.
6. **Check PLC scaling.** Compare raw input data and scaled engineering value.
7. **Compare values.** Compare transmitter/process indication, measured loop current, PLC value, and HMI value.

Quick Diagnostic Checks

Measured Current	What to Check
≈ 4 mA	Signal is near the configured LRV.
≈ 12 mA	Signal is near 50% of a linear configured span.
≈ 20 mA	Signal is near the configured URV.
Below 4 mA	Check transmitter status/configuration, wiring, power, and device-specific fault behavior.
Above 20 mA	Check transmitter configuration and device-specific out-of-range/fault behavior.

Safety / field note: Follow the equipment manufacturer's documentation and site procedures. Verify meter setup and loop configuration before opening or modifying a live circuit.