4-20mA PLC wiring field guide

Current scaling, burden budgeting and model-specific PLC review

Document status - application guide and configuration review checklist. Use a controlled configuration datasheet, approved drawing and written quotation to define the delivered model, ratings, documents and commercial terms.

Identify the analog input before wiring

Record the exact PLC input module, channel mode, supply source and isolation arrangement. A passive current input generally needs an external loop supply. An active input may provide loop excitation. Follow both controlled wiring drawings.

```
Passive AI example: +24V -> TX+; TX- -> AI+; AI COM -> supply 0V
```

Verify the channel is configured for the required current range and observe the manufacturer’s connection diagram. Distinguish a current input from a voltage input, and confirm any required external conversion resistor against the module specification.

Scale current into engineering units

```
velocity = (current_mA - 4) / 16 x full_scale_velocity
```

```
current_mA = 4 + 16 x velocity / full_scale_velocity
```

With a 25.4 mm/s RMS full scale, 4mA = 0, 12mA = 12.7 and 20mA = 25.4 mm/s. With a 25.0 mm/s full scale, 12mA = 12.5 mm/s. One in/s equals 25.4 mm/s.

Handle under-range, over-range, broken-wire and module diagnostic states explicitly. Obtain the sensor’s actual fault-current behavior before selecting current thresholds and alarm delays.

4-20mA PLC wiring field guide (continued)

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Budget the entire loop at design current

```
Rload_max = (Vsupply_min - Vtx_min - Vfixed) / Idesign
            - Rcable - Rbarrier
```

Use volts, amperes and ohms consistently. Idesign is the maximum current that the loop must sustain, including the specified overrange or fault state. Include supply tolerance, fixed isolator drops, cable resistance and barrier resistance once each.

Illustrative arithmetic: 24V minimum supply, 12V transmitter minimum, 22mA design current, no fixed drop, 20 ohm cable and no barrier resistance give an AI load allowance of about 525.5 ohms. These inputs are an example, and require confirmation for the installed devices.

Barrier and grounding review

Obtain the barrier / isolator data, current-dependent voltage drop, maximum supply and approved system drawing. Where intrinsic safety applies, review sensor, barrier and cable entity parameters together. Include the accepted grounding and shield-termination arrangement.

Mounting and EMC checks

Use a rigid bearing-housing seat or qualified pad, confirmed thread and torque. Route the measurement cable according to the installation EMC plan and provide strain relief. A connector shell or cable braid does not by itself define the circuit grounding scheme.

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Siemens S7 normalization pattern

For the exact S7 input module and configured range, obtain rawMin at the lower engineering endpoint and rawMax at the upper endpoint from the module manual. In TIA Portal, map these through NORM_X and SCALE_X using compatible data types.

```
normalized := (raw - rawMin) / (rawMax - rawMin)
```

```
velocity := normalized x fullScaleVelocity
```

Typical conceptual block assignment: NORM_X MIN = rawMin, VALUE = raw, MAX = rawMax. SCALE_X MIN = 0, VALUE = normalized, MAX = fullScaleVelocity. Confirm the actual block interface, numeric types and diagnostic processing for the project.

Rockwell engineering-unit pattern

For the exact ControlLogix / CompactLogix module, first check whether channel configuration already returns engineering units. Otherwise obtain the actual raw endpoints and use a supported scaling instruction or floating-point arithmetic in that controller project.

```
velocity = (raw - rawMin) x fullScale / (rawMax - rawMin)
```

Use module-specific rawMin and rawMax, channel range and data format. Validate the result at the lower endpoint, midpoint and upper endpoint using an approved simulator or calibration process. Instruction availability varies by controller family.

Primary reference locations

https://support.industry.siemens.com/

https://literature.rockwellautomation.com/

Machine evaluation and engineering reference

Select the applicable ISO 20816 part and adopted edition for the machine, support, speed, measurement direction and operating state. Overall housing vibration and changes from a baseline support condition trending. A diagnostic bearing assessment may need high-frequency features or waveforms.

https://www.iso.org/standard/89922.html