Frequently Asked Questions (FAQ)

Q1: What is "True RMS"? Why is it necessary to choose a True RMS transmitter?

Question: Standard transmitters are much cheaper, so why do engineers always insist on using "True RMS" ones?

Answer:

- Definition: True RMS refers to the DC value of an AC signal that performs an equal amount of work over one cycle; its calculation formula takes into account all harmonic components in the waveform.
- Standard (average-value response) transmitters: These typically measure only the peak value of a sine wave or the rectified average value, then multiply it by 1.11 (the sine wave form factor) to estimate the effective value. Once the waveform becomes distorted (such as in inverter outputs, thyristor voltage regulation, switching power supplies, or loads containing a large amount of higher-order harmonics), measurement errors can skyrocket (even as high as 20%–40%).
- Applicable Scenarios: Whenever your site involves variable-frequency drives, chopping, nonlinear loads, complex waveforms, or severe harmonic distortion, you must select a true RMS transmitter to ensure the absolute accuracy and reliability of your measurements.

Q2: How do I correctly select the input range? How should I evaluate the overload capacity?

Question: My motor has a rated current of 10 A, and the starting current may reach 50 A. What input range should I choose for the transmitter? Will the transmitter be damaged?

Answer: Selection Principles:

- The transmitter's input range should be based on the maximum steady-state value during normal operation. It is generally recommended to allow a margin of 20% to 30% (i.e., the maximum value should be approximately 80% of the full scale).
- Regarding startup or surge currents:

1. If you need to monitor the startup process, you must select a model with extremely high overload capacity, one featuring wide-range or peak-hold capabilities, or one with an input range that covers the startup current (e.g., 0–100 A).
2. If you are only monitoring normal operation, the high current during startup will cause a standard transmitter to saturate or go into overflow. High-quality true RMS transmitters are designed with internal overload protection circuits (typically capable of withstanding continuous or short-term overloads of 2 to 10 times the nominal input value, such as 10 x I_n for 5 seconds). Short-term overloads will not burn out the device, but the output will be clamped at the maximum value (e.g., 20 mA).

Q3: Is the input signal AC, DC, or suitable for both AC and DC? How do I distinguish between them when selecting a model?

Question: My system includes both DC bus voltage and AC mains power, or complex signals that combine AC and DC. Which type should I choose?

Answer:

- Pure AC Transmitter: Typically uses the transformer principle (electromagnetic induction) and can only measure AC; it is isolated from DC and does not respond to it.
- Pure DC Transmitter: Typically uses a shunt in combination with isolation amplification or the Hall effect principle; it can only measure DC.
- Universal AC/DC True RMS Transmitter: Utilizes advanced wide-band sampling and true RMS calculation chips (or Hall-effect closed-loop technology) to seamlessly handle pure AC, pure DC, and mixed AC/DC signals (such as rectified ripple DC or AC with DC offset), outputting an accurate composite RMS value. We recommend prioritizing the universal AC/DC type in environments with complex waveforms or unknown power sources.

Q4: Should the output signal be 4–20 mA, 0–10 V, or a digital interface (such as RS485/Modbus)?

Question: The distance between the control cabinet and the field is 150$ meters. Which output signal is best?

Answer:

- 4–20 mA current output (recommended for long-distance industrial applications): Extremely resistant to interference, supports transmission over hundreds or even thousands of meters, and line loss does not affect accuracy; it is the most commonly used standard in industrial field applications.
- 0–10 V / 0–5 V voltage output: Suitable for short-distance transmission within the control cabinet (typically <15 meters) or in

scenarios where the downstream data acquisition card only supports voltage input; however, it is susceptible to electromagnetic interference and experiences voltage drop over long distances.

- RS485 (Modbus-RTU protocol): Suitable for modern smart workshops featuring networks of multiple transmitters and centralized digital monitoring. It simplifies wiring and allows simultaneous reading of multiple parameters, including voltage, current, frequency, and power factor.

Q5: What are the different power supply methods for transmitters? How are three-wire, four-wire, and two-wire systems wired?

Question: I don't know how to wire the transmitter I purchased, especially since I'm confused about the difference between "loop-powered" and "self-powered."

Answer:

- Two-wire (Loop-powered): The transmitter shares two wires with the 4–20 mA signal. These two wires provide both the operating power and transmit the current signal. This is commonly seen in scenarios where a PLC's AI input card includes a power distribution function (24 V DC).
- Three-wire system: One wire each for the positive power supply, positive signal, and common terminal (ground). This is commonly seen in voltage-output transmitters (0–10 V) or some independently powered current transmitters.
- Four-wire system (independently powered): Two power supply wires (e.g., 220 V AC or 24 V DC) and two signal output wires (4–20 mA) are completely independent. This configuration offers the highest resistance to interference and is suitable for industrial environments requiring high power and high isolation.
- Golden Rule for Wiring: Before beginning work, be sure to verify the wiring diagram on the side of the product housing. Never perform wiring while the device is energized to prevent reverse polarity from burning out internal core components.

Q6: What are the wiring specifications for installing transmitters in environments with high levels of electromagnetic interference (e.g., near high-power variable frequency drives)?

Question: What should I do if, after installing the transmitter, the output signal needle keeps fluctuating erratically or the PLC readings are unstable?

Answer:

- Shielded Cable Specifications: Output signal lines must use shielded twisted-pair cable, and the shield must be reliably grounded at a single point within the control cabinet (grounding at both ends is strictly prohibited to prevent ground loop currents from introducing interference).
- Cabling Distance: Signal cables must not be laid parallel to or in close proximity to power cables (such as inverter output cables or high-voltage power cables). If they must cross, they should do so at a 90° angle or be isolated by running through metal conduit.
- Power Isolation: If the on-site power grid contains extremely high levels of harmonics, it is recommended to install an AC/DC isolation power supply module or a power filter for the transmitter's independent operating power supply.

Q7: The values measured on-site with a multimeter do not match the values the transmitter sends to the PLC. What is the cause?

Question: When I measure the transmitter's output directly with a multimeter, it reads 12 mA, but the data displayed on the PLC screen is incorrect. How should I troubleshoot this?

Answer:

Troubleshooting Steps:

1. Check the scaling: Verify that the upper and lower limits of the engineering variables in the PLC configuration software (e.g., 4 mA corresponds to 0 A, 20 mA corresponds to 100 A) exactly match the transmitter's actual hardware range.
2. Check the input load resistance (impedance matching): For current-output transmitters, ensure that the input impedance of the downstream receiving device falls within the transmitter's maximum allowable load range (typically <500 Ω or 750 Ω). Excessive impedance can cause the output to be pulled down.
3. Troubleshoot ground potential differences: If the transmitter is not fully isolated, shared grounding among multiple devices may introduce common-mode voltage, leading to measurement errors. It is recommended to use a digital multimeter connected in series with the circuit to verify the actual current.
4.

Q8: Does the transmitter support field calibration or zero/span adjustment?

Question: I'm concerned about temperature drift or a decline in accuracy over time. Can users calibrate the device themselves?

Answer:

- High-quality true RMS transmitters are fully calibrated across their entire measurement range using high-precision reference sources (such as Fluke calibration standards) before leaving the factory.

- Some high-end digital transmitters or those equipped with buttons or potentiometers support on-site fine-tuning of the zero point and full-scale span. If a professional calibration source is not available, users are advised not to adjust the internal potentiometers arbitrarily to avoid compromising the factory calibration accuracy. If the transmitter is found to be out of tolerance, it is recommended to return it to the manufacturer or submit it to a local metrology and quality inspection department for verification.

Q9: Common Causes and Troubleshooting Guide for Transmitter Output Signal Failure (Dead Zero or No Response)?

Question: After power-up, the output remains at 4–20 mA (or 0–10 V) even though there is clearly current/voltage at the input. What could be the problem?

Answer:

Symptoms	Possible Causes	Troubleshooting and Solutions
Output is consistently at dead zero / minimum value	1. Power supply failure or low voltage 2. Internal fuse blown / Open circuit at the input 3. Input signal is below the transmitter's deadband or has not reached the activation threshold	1. Use a multimeter to check whether the voltage at the transmitter's power supply terminals is normal (e.g., 24 VDC). 2. Check whether the input sampling circuit has good contact. 3. Verify that the input signal is greater than the transmitter's minimum measurable value.
Output is saturated at full scale (locked at 20 mA)	1. Input signal severely exceeds the measurement range 2. Input polarity is reversed (for certain AC/DC or DC models) 3. Internal conditioning circuit has been damaged by a surge	1. Measure whether the actual input value exceeds the transmitter's nominal maximum range. 2. Check whether the positive and negative terminals of the DC input are reversed. 3. If saturation persists after powering off and restarting, the hardware may be damaged and needs to be replaced.
Output value fluctuates wildly and is unstable	1. Interference from strong electromagnetic radiation at the site 2. The input waveform itself contains severe high-frequency harmonics and exhibits significant fluctuations	1. Check the grounding of the shielded cable. 2. Select a model with stronger filtering capabilities or add software-based smoothing filters.

Q10: What are the operating temperature and humidity requirements for transmitters? What is their typical service life?

Question: Will installing the transmitter in an outdoor control cabinet or a high-temperature workshop affect its service life?

Answer:

- Environmental Requirements: Standard industrial-grade transmitters typically operate within a temperature range of -20°C to +60°C (some wide-temperature military/industrial-grade models can operate from -40°C to +85°C), with relative humidity between 5% and 95% RH (non-condensing).
- Protection Rating: If installed outdoors or in harsh, dusty, or humid environments, an enclosure with an IP65 rating or higher is recommended.
- Design Life: High-quality transmitters utilize long-life solid-state electronic components and a highly reliable isolated power supply design. The Mean Time Between Failures (MTBF) is typically greater than 50,000 hours (equivalent to 5 to 10 years or more of

continuous operation). Regularly checking for loose terminal connections and protecting the unit from moisture and dust will ensure long-term, stable operation.