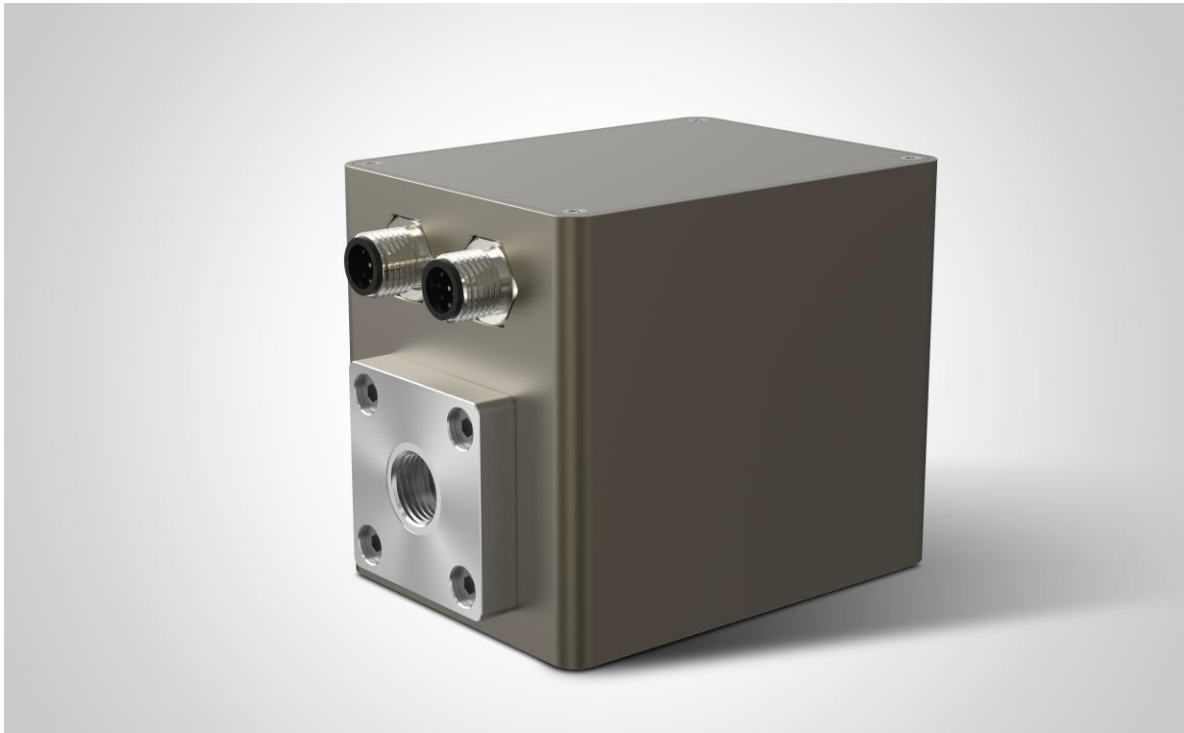


LWTX-4501 Iron Chip Series Metal Abrasive Sensor



High speed, Precision, Robustness

Product Description

The LWTX-4501 metal abrasion sensor is a real-time ferromagnetic and non-ferromagnetic abrasion monitoring sensor. It utilises an advanced triple coil electromagnetic induction principle with an integrated high sensitivity data sampling and processing unit to provide real-time monitoring of wear and tear on large industrial equipment.

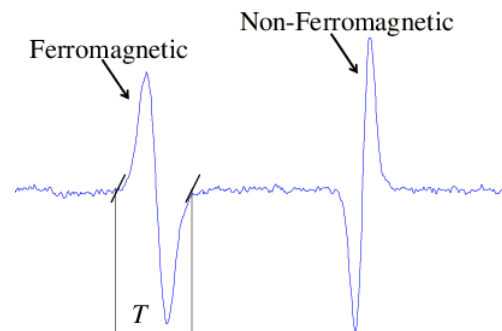
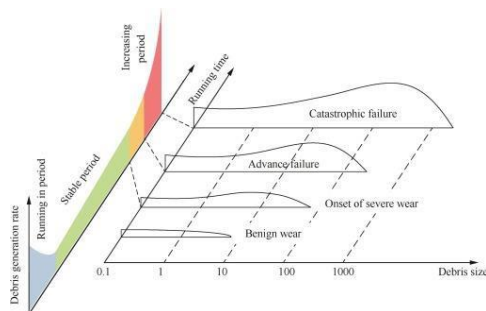
The LWTX-4501 captures ferromagnetic metal particles greater than 40µm in diameter and non-ferromagnetic metal particles greater than 150µm in diameter, and detects abrasive particles and outputs data through 10 size distributions. The LWTX-4501 also provides temperature measurement inside the sensor and flow rate estimation of abrasive particles.

By continuously monitoring the production of wear debris, the LWTX-4501 alerts the user to the earliest stages of equipment failure, allowing for less costly maintenance measures compared to traditional schedules.

Measuring Principle

The LWTX-4501 incorporates two sets of high performance reverse wound excitation coils and one set of high performance induction coils. Both the excitation and induction coils operate at resonance. When a metal grain passes through the pipeline, the magnetic flux change of the excitation coil is received by the induction coil, and the signal is captured and reported in real time by the high sensitivity sampling unit, bandpass filtering unit, phase and amplitude comparison unit, signal amplification unit, low-pass filtering unit and signal extraction unit, etc. The LWTX-4501 is capable of detecting 40µm iron particles (Fe) and 150µm non-ferrous particles (NFe).

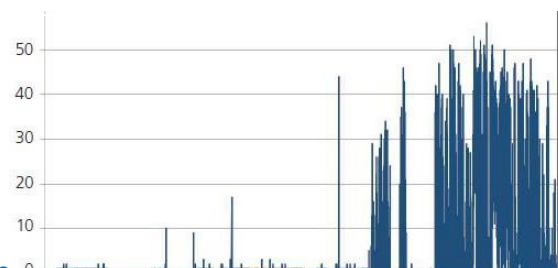
LWTX-4501 achieves the detection capability of 40µm iron particles (Fe) and 150µm non-ferrous particles (NFe).



Key Features

- 40µm ferromagnetic & 150µm non-ferromagnetic grit detection capability
- Tenth dimension tape output / abrasive mass estimation
- System flow rate estimation data output
- Abnormal wear detection to protect valuable Assets
- Measurement free from external metal and magnetic fields
- Measurement is unaffected by air bubbles and moisture in the oil
- Fast response with adjustable data accumulation period
- Excellent chemical and pressure resistance
- No moving or consumable parts, 10 year design life
- 2.5kV isolated RS485 communications

Fe size tape	NFe size tape
40 ~ 99µm	150 ~ 199µm
100 ~ 199µm	200 ~ 299µm
200 ~ 299µm	300 ~ 399µm
300 ~ 399µm	400 ~ 499µm
≥ 400µm	≥ 500µm



Applications

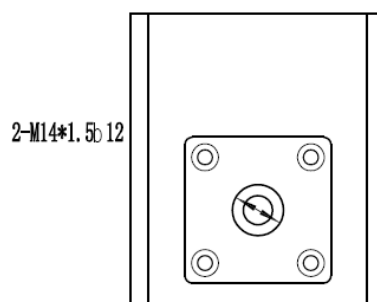
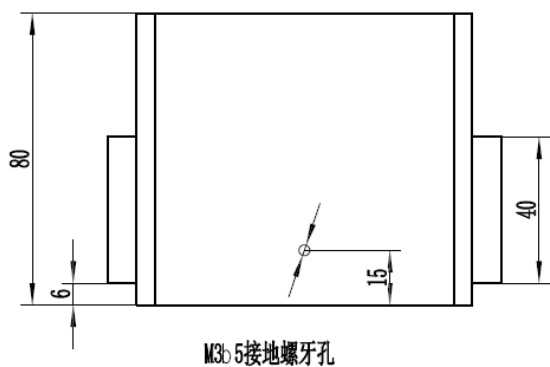
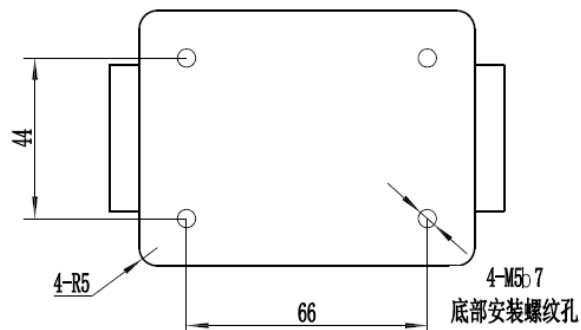
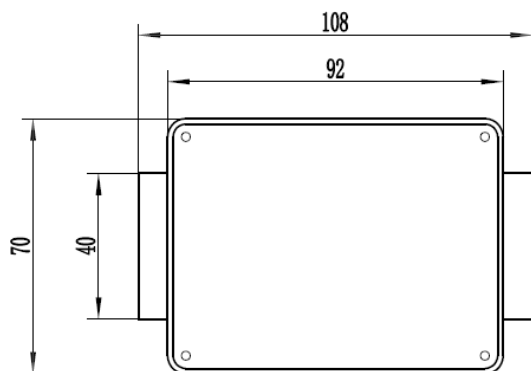
- Large-scale engineering machinery and equipment for wind, thermal and hydroelectric power generation industries
- Transport vehicles
- Aviation, navigation, railway and other transport industries
- Offshore engineering such as drilling platforms
- Fuel storage and transport link refining, oil industry
- Seawater treatment and testing equipment oil treatment equipment
- Chemical analysis
- Oil treatment and filtration systems for production process quality management
- Coating, ink and printing industry medical equipment



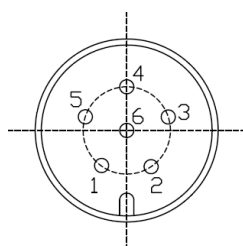
Technical Parameters

Detection capability	Ferromagnetic abrasive Fe > 40μm (ESD) 5 grades
	Non-ferromagnetic abrasive grain NFe > 150μm (ESD) 5 grades
Statistical cycle	Start-up self-test 30 seconds (first time), counting interval 300 ~ 3600 seconds adjustable
Particle count	Max 100 pcs/sec
Allowed flow	0.3 ... 9 L/m (0.1 ... 3m/s)
Pipe Size	Φ8mm
Digital output	RS485 MODBUS RTU, Isolated Voltage 2.5kv
Operating power	DC 24V±10%, < 200mA
Probe pressure resistance	10bar Max
Applicable fluids	Lubricants and hydraulic fluids (synthetic and mineral base), etc.
Fluid temperature	-20 ... 80 °C
Environmental temperature	-20 ... 85 °C
Shell material	Stainless Steel, Anodised Aluminium
Structural dimension	108×70×80 mm (Length x Width x Height)
Screw interface	M14*1.5
Weight	<1.0 kg
Protection class	IP65
Connection cable	2 m M8 - 6 core straight
Electromagnetic compatibility	EN 61326-1 EN 61326-2-3 ICES-003 Class B

Structural dimension (mm)



Interface definition (M8 male)



1)	+24V DC	RED
3)	GND	BLACK
2)	RS485+/A	WHITE
4)	RS485-/B	GREEN

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Particle Counter Specialist Supplier

LWTX-4501 On-Line Abrasive Sensor Communication Protocol (Conventional)

LWTX-4501 online abrasive grain sensor (hereinafter referred to as the sensor) provides a standard RS485 communication interface, using MODBUS RTU communication protocol to communicate with the host. In a complete online monitoring system, the master control device acts as the host and the sensor acts as the slave. Each communication handshake always consists of the host sending an access request and the slave responding.

Use of specification standards: "GB/T19582-2008 Modbus protocol-based industrial automation network specification".

1. Data Frame Formatting

The format of each byte (frame) sent by the sensor completely follows the MODBUS communication protocol of GB/T19582-2008 standard, and the function code supports reading, writing and batch writing. The CRC checksum: (CRC-16/MODBUS $x_{16}+x_{15}+x_{2+1}$) starts from "address code" and ends with "data". The data frame contains start bit, information bit and stop bit, total 10 bits, as shown in Figure 1.

Frame format (10-bit):

starting position	D0	D1	D2	D3	D4	D5	D6	D7	stop bit
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Figure 1 Data frame format

The specific definitions are as follows:

Bit 1: Start bit ("0" is valid);

Bits 2 to 9: Information bits;

Bit 10: stop bit ("1" valid);

Size: The data frame adopts the order of sending and reading from low to high bit, for multi-byte data, the low byte is transmitted first, followed by the high byte. For 16-bit or 32-bit binary data, it is divided into two or four data frames and transmitted serially in the order from low byte to high byte.

2. Message Format

The format of each message received and sent by the sensor is as follows:

--address

--Function code

--Data number

--Data 1

--...

--Data n

--CRC16 checksum

3. Serial Port Setting

parametric	causality
baud	9600
data bit	8
parity check	无
stop bit	1
sensor address	1

Table 1 Sensor serial communication default settings

4. MODBUS Function Code

function code		define
03	0x03	Read Holding Register
04	0x04	Read Input Register
06	0x06	Write Single Register
16	0x10	Write multiple register

Table 2 Sensor modbus function codes

4.1 Holding register (0x03 function code)

register address	causality	Read/Write	16-bit word length	unit
0x100A	direction	Read/Write	1	
0x100B	cumulative time	Read/Write	1	s
0x100C	sensor serial number	Read	10	
0x9000	sensor address	Read/Write	1	

Table 3 modbus holding registers

Note: 1) Direction - refers to the direction of flow of the liquid through the sensor, the default is 0 (from the direction of the M12 electrical interface into the oil), optional 1 (at this time the flow direction is reversed);

4.2 Input register (0x04 function code)

Table 4 modbus input register

register address	causality	Read/Write	16-bit word length	unit	data type
0x000C	Quantity of ferromagnetic particles 1 grade (40-99um)	Read	2	corn	unsigned int
0x000E	Quantity of ferromagnetic particles 2 grade (100-199um)	Read	2	corn	unsigned int
0x0010	Quantity of ferromagnetic particles 3 grade (200-299um)	Read	2	corn	unsigned int
0x0012	Quantity of ferromagnetic particles 4 grade (300-399um)	Read	2	corn	unsigned int
0x0014	Quantity of ferromagnetic particles 5 grade (>400um)	Read	2	corn	unsigned int
0x0016	Total number of ferromagnetic particles	Read	2	corn	unsigned int
0x0018	Quantity of non-ferromagnetic particles 1 grade (150-199um)	Read	2	corn	unsigned int
0x001A	Quantity of non-ferromagnetic particles 2 grade (200-299um)	Read	2	corn	unsigned int
0x001C	Quantity of non-ferromagnetic particles 3 grade (300-399um)	Read	2	corn	unsigned int
0x001E	Quantity of non-ferromagnetic particles 4 grade (400-499um)	Read	2	corn	unsigned int
0x0020	Quantity of non-ferromagnetic particles 5 grade (>500um)	Read	2	corn	unsigned int
0x0022	Total number of non-ferromagnetic particles	Read	2	corn	unsigned int
0x0024	In-shell temperature[The displayed value must be divided by 1000]	Read	2	°C	signed int
0x0026	Estimated flow rate[Minecraft Business Province (Israel) 1000]	Read	2	m/s	unsigned int

5. Example of communication

5.1 Read current address

Sensor Default Address 1;

Example of reading the current address of the sensor [sensor current address is 1]:

apply		response	
domain name	(hexadecimal)	domain name	(hexadecimal)
address code	FF	address code	FF
function code	03	function code	03
data home address Hi	90	data byte length	02
data home address Lo	00	current address Hi	00
data item Hi	00	current address Lo	01
data item Lo	01	CRC16 Lo	50
CRC16 Lo	BC	CRC16 Hi	50
CRC16 Hi	D4		

Table 5 Example of reading address

5.2 Change address

Example of changing the sensor address [changing the sensor from the current address 1 to address 5]:

apply		response	
domain name	(hexadecimal)	domain name	(hexadecimal)
current address	01	current address	01
function code	06	function code	06
data home address Hi	90	data home address Hi	90
data home address Lo	00	data home address Lo	00
new address Hi	00	new address Hi	00
new address Lo	05	new address Lo	05
CRC16 Lo	64	CRC16 Lo	64
CRC16 Hi	C9	CRC16 Hi	C9

Table 6 Example of setting address

5.3 Read the number of particles

Example of reading the number of particles in the sensor [2 ferromagnetic particles in 2nd gear, 3 ferromagnetic particles in 3rd gear, 4 ferromagnetic particles in 5th gear, 9 ferromagnetic particles, 4 non-ferromagnetic particles in 2nd gear, 2 non-ferromagnetic particles in 3rd gear, 3 non-ferromagnetic particles in 5th gear, 9 non-ferromagnetic particles, 32.687° C, 0.28m/s flow rate]:: The temperature of the housing is 32.687° C, the flow rate is 0.28m/sec. /s].

apply		response	
domain name	(hexadecimal)	domain name	(hexadecimal)
address	01	address	01
function code	04	function code	04
data home address Hi	00	Number of data bytes	38
data home address Lo	0C	Quantity of ferromagnetic particles 1 grade	00 00 00 00
data item Hi	00	Quantity of ferromagnetic particles 2 grade	02 00 00 00
data item Lo	1C	Quantity of ferromagnetic particles 3 grade	03 00 00 00
CRC16 Lo	31	Quantity of ferromagnetic particles 4 grade	00 00 00 00
CRC16 Hi	C0	Quantity of ferromagnetic particles 5 grade	04 00 00 00
		Total number of ferromagnetic particles	09 00 00 00
		Quantity of non-ferromagnetic particles 1 grade	00 00 00 00
		Quantity of non-ferromagnetic particles 2 grade	04 00 00 00
		Quantity of non-ferromagnetic particles 3 grade	02 00 00 00
		Quantity of non-ferromagnetic particles 4 grade	00 00 00 00
		Quantity of non-ferromagnetic particles 5 grade	03 00 00 00
		Total number of non-ferromagnetic particles	09 00 00 00
		Shell temperature	AF 7F 00 00
		flow rate	18 01 00 00
		CRC16 Lo	24
		CRC16 Hi	C7
Tx:01 04 00 0C 00 1C 31 C0			
Rx:01 04 38 00 00 00 00 02 00 00 00 03 00 00 00 00 00 00 04 00 00 00 09 00			
00 00 00 00 00 00 04 00 00 00 02 00 00 00 00 00 00 00 03 00 00 00 09 00 00 00			
AF 7F 00 00 18 01 00 00 24 C7			

Table 7 Example of reading sensor particle count

5.4 Zeroing of statistical data

Data Zero command [sensor current address is 1]:

01 05 00 00 F0 00 89 CA

5.5 Accumulation function description

Accumulation time [default]: 300 seconds;

Accumulated time setting mode:

- 1) 1 second [data refresh in real time];
- 2) 300...3600 seconds [Particle data is automatically accumulated during the accumulation time, and particle data is automatically cleared when the accumulation time expires];