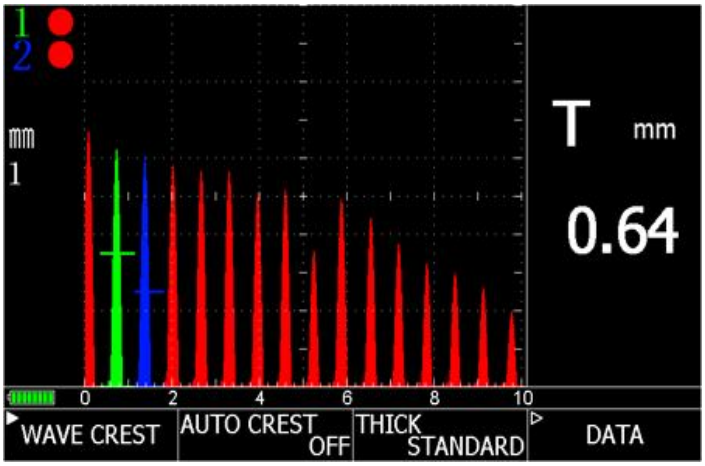
# CTS-409 Eletromagnetic Ultrasonic Thickness Gauge

## General Information of CTS-409


The CTS-409 is a portable electromagnetic ultrasonic (abbr. as “EMAT”) thickness gauge newly launched by Goworld to be used without couplant or direct contact on materials of metal or magnetism, based on electromagnetic-acoustic transduction. Due to unaffectedness by surface of the object, it can be applied to those with rust, oxide layer or coating, like oil pipe or aircraft parts, saving the effort to clear them off. Angle shift of the probe has no effect on the result, with the available gauge range **2~300mm** and the precision up to 0.01mm. This instrument can also work on hot objects such as forged pieces, radiators and heat exchangers, assisted by necessary kittings supplied by the manufacturer. There’re optional functionalities like B-Scan, RS-485 BUS networking, GPRS wireless communicating and SMS for the users to realize their modern dreams on NDT instruments.

## Areas of Application

- Metallurgy
- Aerospace
- Pressure Vessel
- Thermal Circulation
- Shipbuilding
- Machinery
- Construction
- Power Generation
- Nuclear Power
- Refrigeration




## Purposes

- To gauge thickness of metal or magnetic objects with rough surface that might cause poor coupling for pure ultrasonic transduction
- To get precise thickness data of metal part beneath coated layer, such as rust, oxide or artificial coating material.

— oil pipes, aircraft parts

- To work under special situation that there’s air gap or some obstacle stuck between the transducer and the metal object.
- As an solution to thickness gauging on objects of high temperature without loss of data and damage to the tools (transducers & instrument) and the operator — forged pieces, radiators, heat exchangers (up to 300℃，at-and-away: up to 600℃)
- to make the job of gauging go on under severely cold weather (lowest to -40℃)

## EMAT Transducer

The CTS-409 is kitted with an EMAT probe (2MHZ, but can be customized to different specification) that can induce eddy current as to generate ultrasonic wave on the surface of a metal or magnetic object by permanent magnet and electrified coil. Strong constitution by solid casing and temp-insensitive element enables this transducer to function over harsh conditions like coarse-textured interface and extreme climate (kitted with heat-proof probe cable).

## Other Highlights

### Heat-proof Handle

- To effect gauging at a distance
- To keep the operator away from the object if it's too hot while doing the job and protected by the adiabatic sock gloved on the grip end from being scalded.

The probe is to be caught by the head as shown on the left:

### Linear Scanner

- Special design of panzer-like appearance with two groups of wheels respectively at the front and the rear to change the spot of probe more conveniently against its powerful magnetism to the surface of the object.
- To run the probe more smoothly and quickly over surface with high roughness.
- To easily control the pace of movement while doing time-based B-scan thickness gauging.
- To avoid damage to the probe by rugged surface of the object (direct contact)

The probe is to be mounted on the scanner as the shown on the left:

## Multi-orienting Scanner

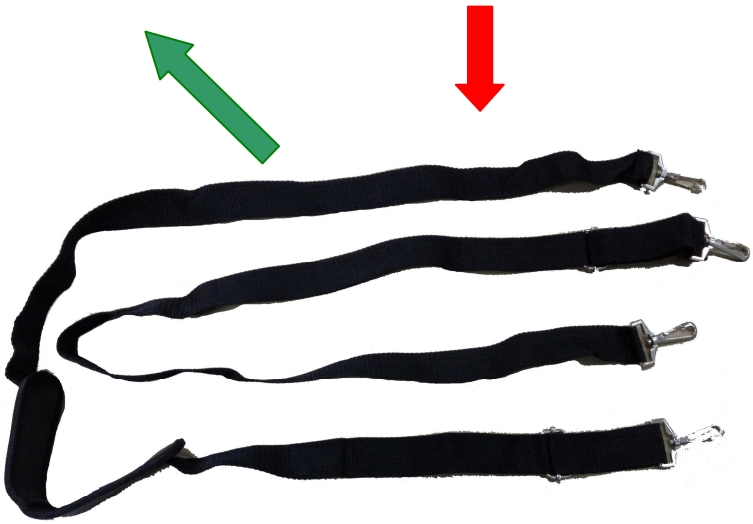
- With four metal balls respectively at the bottom of each corner, this scanner enables the probe to be moved and turned in different directions more flexibly.

## Probe Elevator

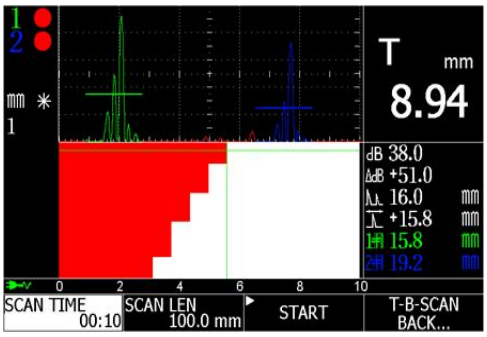
- To lift the probe up by some gap from the surface of the object in case that the operator could not move the probe strongly attached to the surface by magnetism. (But the gap should not be more than 3mm or else the signal would be too weak to get)


## Take-along Combo

**The package also contains a leather sheath. One advantage is to protect the instrument from being stained by liquid or hurt by other sharp object. The second advantage is to act as a pad to buffer the instrument from tumble. The last but not the least, is to be used jointly with the sling also provided in the package to tie the instrument to the operator whose hands are both engaged, such as handling the probe and the object, or keeping balance amid aloft work. An on-sale instrument packed in the suitcase will be nipped up with a grip belt for more convenience, as indicated on the left:**



## Optional Modules




### Time-based B-scan

- This optional functionality is meant for characterizing the contour of the object (usually for stairs-like types) . That each pace of position shift (X-axis) is supposed to last for 3s is set for the program and it will automatically register the thickness value “belonging” to next pace to next position. Thus the operator should strictly follow the pace or else the data would be wrongly registered or missed.


### Networking/GPRS/SMS

- Goworld also provides optional techs like RS-485 BUS networking, GPRS wireless communicating and short message service (SMS) for the users to realize their modern dreams on NDT instruments.

## Main Advantages

- A-scan display with “gate” to distinguish between interface echo, bottom echo and boundary echo, and gauge the thickness value by distance between echoes (dual-gate mode & auto crest), which is the best approach to inspecting objects with multiple layers of different kinds of metal.
- Optional Time-based B-scan mode to characterize the contour of stair-like objects.
- Weighing only 1.0kg with battery, a handy instrument saving efforts in on-the-move job.
- Standard kit includes heat-proof handle, linear scanner, multi-orienting scanner, probe elevator in consideration of possible conditions under which the users work with this instrument.
- Optional functionalities like RS-485 BUS networking, GPRS wireless communicating and SMS for the users to realize their modern dreams on NDT instruments.
- High suitability of the probe to work under the temperature ranging from -40℃ to 300℃ in general duration, and up to 600℃within at-away interval, especially valuable for extreme conditions

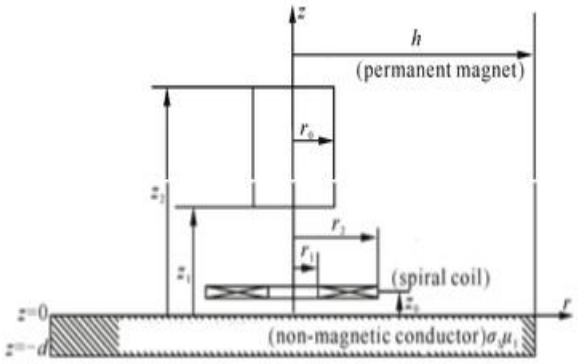
1 • Available gauge range 2~300mm with precision up to 0.01mm makes it excel in the EMAT world.

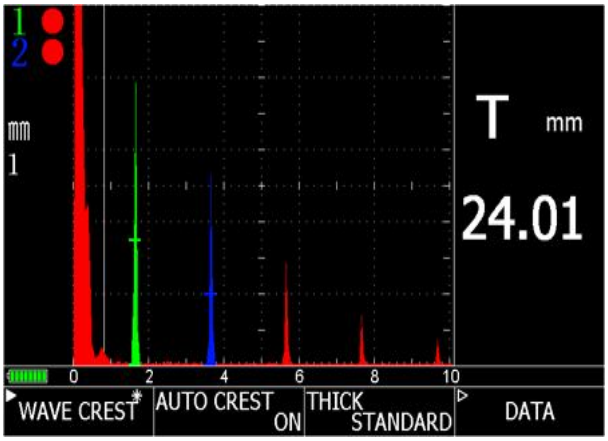
1 • A wonderful substitute for conventional UT instrument to deal with poor coupling conditions such as roughness and rust, without being affected by these factors, saving effort to clear them off. Also there’s no need to adapt the bottom of the probe to the curvature of the pipe to be inspected.

- Contactless gauging is allowable by max 3mm away, which makes thickness gauging immune to gapping, obstruction, and possible for metal beneath coating.

1 • Com App will be offered to read the file saved in the instrument and transferred to PC by USB for further analysis.

## The Process of Thickness Gauging by EMAT Instrument




The EMAT probe is mainly constituted by the permanent magnet and spiral coil. When the coil get electrified, these two parts collectively generates induced magnetic field which subsequently produces eddy current on the surface, as the cause of Lorentz force to drive oscillation of the metal particles by that the ultrasonic sheer wave comes into being. Acquisition of echo signals is a reverse process.

The CTS-409 adopts dual-gate mode to quickly get the time delay between the 1st and the 2nd echo, i.e. the time spent by the 2nd echo traveling to and fro one time inside the object. The acoustic path, i.e. the thickness of the object, can be calculated at once with high precision.

## This product comprises

- 1 set of CTS-409 EMAT Thickness Gauge
- 1 Power Adapter (instrument powering, in-set battery charging)
- 1 Li Battery
- 1 EMAT Probe
- 1 Probe Elevator
- 1 Probe Spanner
- 1 Linear Scanner
- 1 Multi-oriented Scanner
- 1 Heat-proof Handle
- 1 Probe Cable (Ordinary Temperature)
- 1 Probe Cable (High Temperature)
- 1 AC Power Cable
- 1 Screwdriver for locking the back cover of the battery container
- 1 Leather Sheath (kitted with 1 leather sling & 1 grip belt)
- 1 Suitcase for packing all the things up and carrying on the move
- 1 CD burned of ComApp and user manual.
- • Spare Battery Charger (Optional)

**Documents**

1 Certificate of Quality

Battery

Power Adapter

Transducer (Probe)

Probe Elevator

Linear Scanner

Sling

Leather Sheath

Multi-oriented Scanner

Screwdriver

CD

Probe Cable
(Ordinary Temperature)

Probe Cable
(High Temperature)

AC Power Cable

Suitcase

## Technical Datasheet

| | |
|---|---|
| Transmitting Pulse | Square Wave Pulse；<br>Transmitting Pulse Voltage: 50~350V, adjustable with 25V per increment.<br>Pulse Width: 50~800ns, adjustable with 5ns per increment. |
| Working Mode | Single/Dual |
| Damping | 400/80Ω |
| Working Frequency | 300KHZ~4MHZ |
| Gain | 0.0~110.0dB. Optional Step shift: 0.1, 1.0, 2.0, 6.0dB. Shift 0.1dB with smart acceleration |
| Gauge Availability | 2.0~300mm at 45# steel velocity. precision up to 0.01mm |
| Rectification Options | 1/2 PW, 1/2 NW, FW & RF |
| Gate | Dual-gate thickness gauging mode by auto crest. Gauge spot mode optional: Front/Crest |
| Display | 4.3'' TG TFT-color LCD; Resolution:800×480 |
| Receiving Gain Control | Automatic, program control |
| Probe Delay Availability | 0-999.9μs |
| PRF | 25~3200HZ |
| Vertical Linearity Error | ≤3% |
| Horizontal Linearity Error | ≤0.4% |
| Surplus Sensitivity | ≥60dB(200Φ2 FBH, narrow band) |
| Driver | Permanent Magnet |
| Dynamic Range | ≥30dB |
| Reject | 0~90% |
| Ports | Probe Cable Connector: BNC /(customizable) ; USB |
| Power Supply | Large-capacity Li battery without memory effect; Battery Life: 8 hrs |
| Grade of Protection | IP54 |
| Ambient Temperature | -30~50℃ |
| Relative Humidity | 20%~95% |
| Weight | 1.0Kg (with battery) |
| Dimension (L×W×H) | Upper Part: 215mm×126mm×53mm<br>Lower Part: 215mm×104mm×42mm |