SISGEO ® RAIL

IOT IN MOTION

DIGITAL RDS SYSTEM

USER MANUAL

INDEX

Notes on the use of product

For safe and efficient use of the product, please read carefully the following instructions before starting any operation.

Any use of the product other than the one described in this manual shall be considered the user's full responsibility.

The same applies for any unauthorized modifications.

In addition to the hereby listed standards, the user must comply with the provisions of the current legislation regarding personal safety and health together with all other persons in the workplace.

SISGEO is not responsible for any accident, breakdown or other problems due to lack of knowledge and / or non-compliance with the requirements contained in this manual.

Check that the product has not been damaged during the transport.

Verify that the package includes all items as well as any requested optional accessories; if anything is missing, please promptly contact SISGEO.

The user must strictly follow all the operations described in this manual.

Maintenance or repair of the device is permitted only by authorized operators.

These operators must be physically and intellectually suitable.

For information about instrument or to order spare parts, always specify the product information which can be found on the identification label.

When replacing parts, always use ORIGINAL SPARE PARTS.

The manufacturer reserves the right to make either technical and / or commercial changes without prior notice.

It is our policy to keep manuals continuously updated.

Symbols

 Pay particular attention to the following instruction.

Identification

Instruments can be identified
- From a production lot number (written on the Compliance Certificate)
- From a serial number (s/n) engraved indelibly on the instrument
- From a label on the instrument
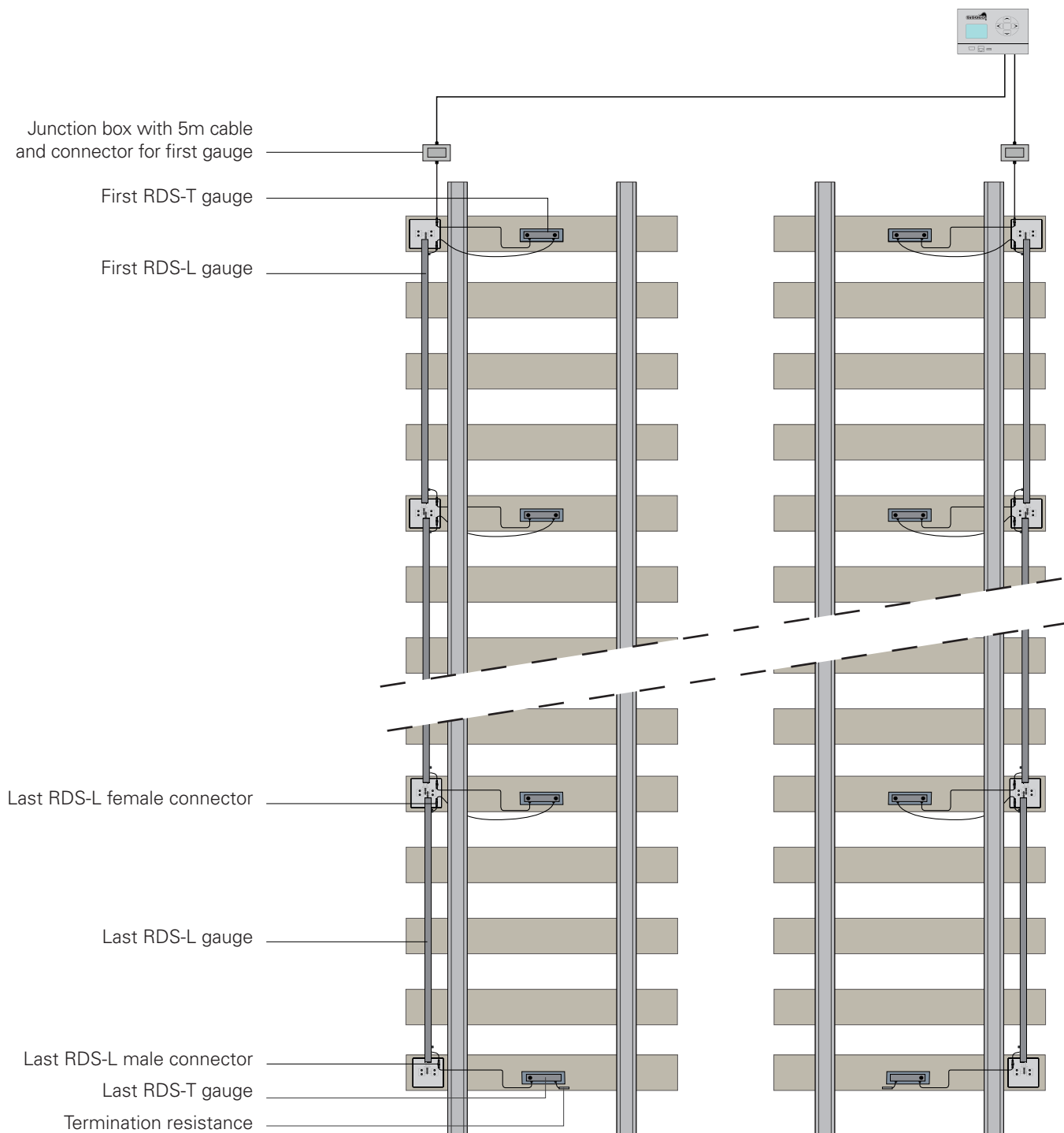- From a label on the cable

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Note

The present Manual is issued by SISGEO in English Language and translated in other different languages.
In order to avoid discrepancies and disagreements on the interpretation of the meanings, Sisgeo Srl declares that English Language prevails

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INTRODUCTION

The RDS System is used to monitor longitudinal and transversal movements of the rail. If supplied with OMNIAlog datalogger, allows to manage the alarm threshold and remote data transmission.

Junction box with 5m cable and connector for first gauge

First RDS-T gauge

First RDS-L gauge

Last RDS-L female connector

Last RDS-L gauge

Last RDS-L male connector

Last RDS-T gauge

Termination resistance

SISGEO suggests that each electrical signal chain isn't longer than 250m. Higher lenghts could cause a voltage drop in the powering. For more detail please refer to the FAQ#073 published on SISGEO web site.

DESCRIPTION

The **RDS-L (longitudinal) system** is used to monitor longitudinal axis deformation of the rail. It consists in a series of digital sensors (RS-485 output with ModBUS protocol) able to read tilt and temperature, assembled into aluminium bars connected through junctions to fixing/anchoring on plates. Each RDS-L have at the ends one telescopic mechanical joint and one fix mechanical joint.

The RDS-L are electrically connected in chain through male/female shielded cables and connectors.
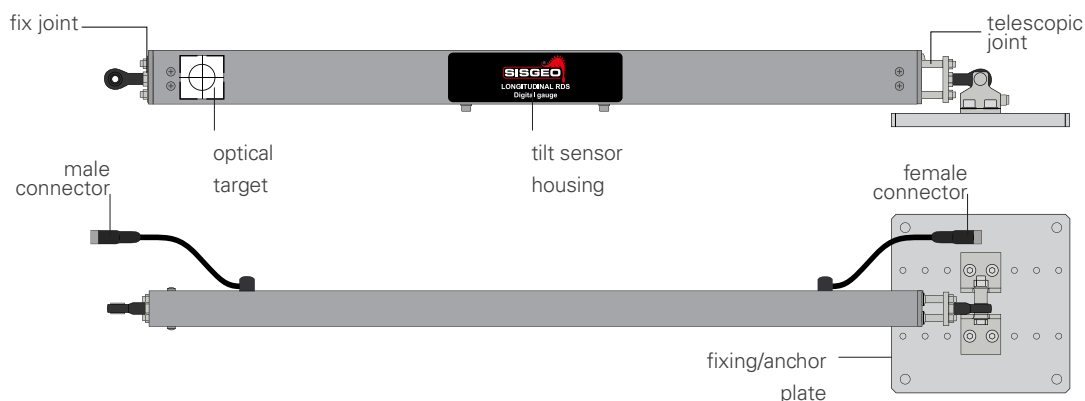
The **RDS-T (transversal) system** is used to monitor the railway twisting / cant.

It consists in a digitial sensor (tilt and temperature) fixed on a plate. The plate is positioned on the sleeper and RDS-T are connected to the RDS-L through shileded cables/connectors.

Main parameters configured at factory for each gauge:
- Serial number;
- Calibration parameters;
- RS485 address. Each RDS has an univocal address also reported in a label on the cable.
- Powering type :
    - A) always-on (all RDS switched on together)
    - B) timed (only one RDS switched on at time)

In "always-on" the consumption is higher (and the voltage drops alonge the cable could be heavy) but the reading frequency is higher .

In "timed" the incremental delay [sec] and the warm-up time [sec] are set. Every RDS is turned on, read and then turned off from the Modbus master.

- Unit of measurement: the standard output is sinα. Upon request is possible to configure RDS with Ksinα with K≠1 or another unit of measurement (mm/m or °).

✋ NOTE: RDS-L and RDS-T gauge can be installed in the same project and can be electrically connected in mixed chain.
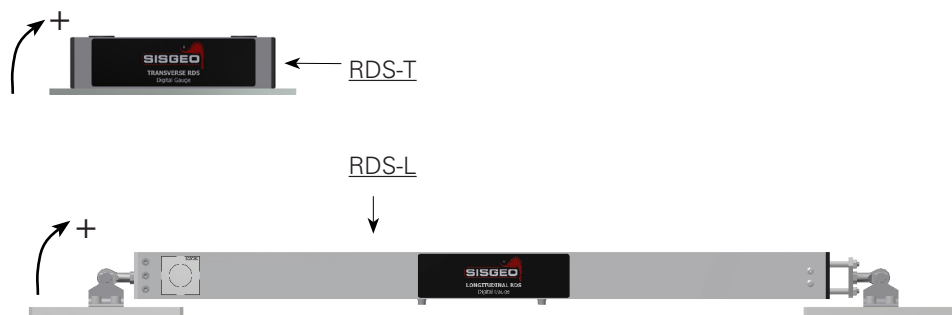
PRELIMINARY CHECKS

Useful tools

For installation using resin on concrete sleepers:
- spanner nr. 17 (RDS-L)
- allen key nr. 3 (RDS-T)
- resin suitable for your support
- spirit-level

For installation using screws on wooden sleepers:
- spanner nr. 17 (RDS-L)
- allen-key nr. 3 (RDS-T)
- screws suitable for wood DIN 571 UNI 704 Ø10mm x 80mm
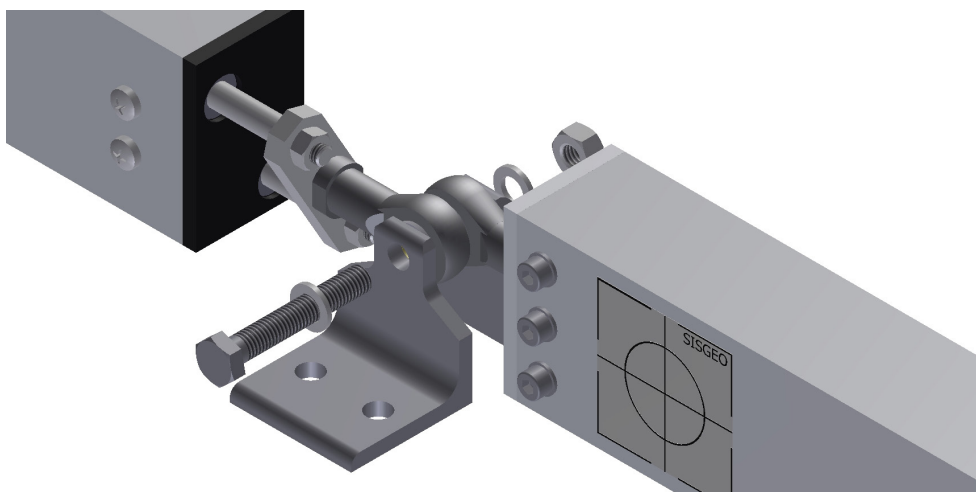- drill and screwdriver
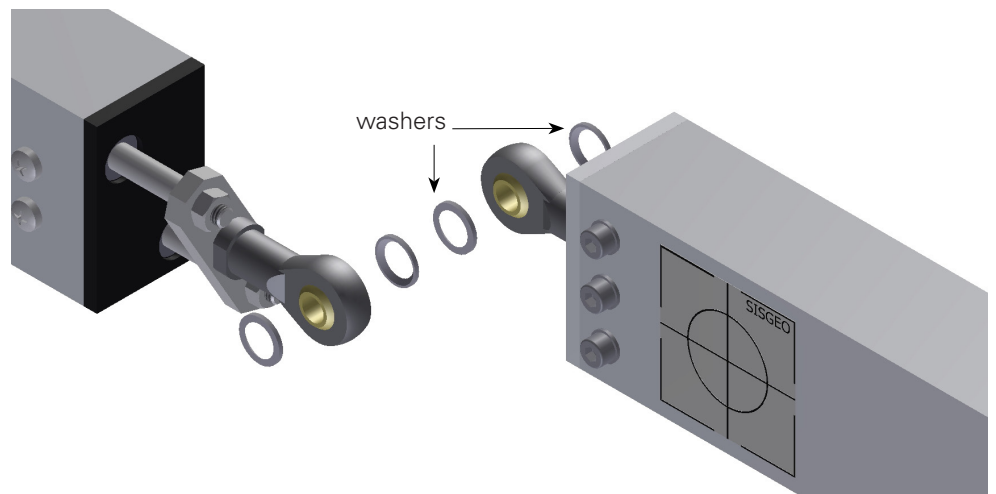- sprit-level

Sign convention


INSTALLATION

RDS-L GAUGES

The following pictures show how to mecanically connect the RDS-L beams one to each others.

washers

The junctions has aluminum washers to reduce the horizontal movement. They should be removed if more movement is needed, for example a curve in the rail.

The RDS-L gauge should be installed alternatively as shown here below in order to keep a stright line of gauges.


Alternate installation
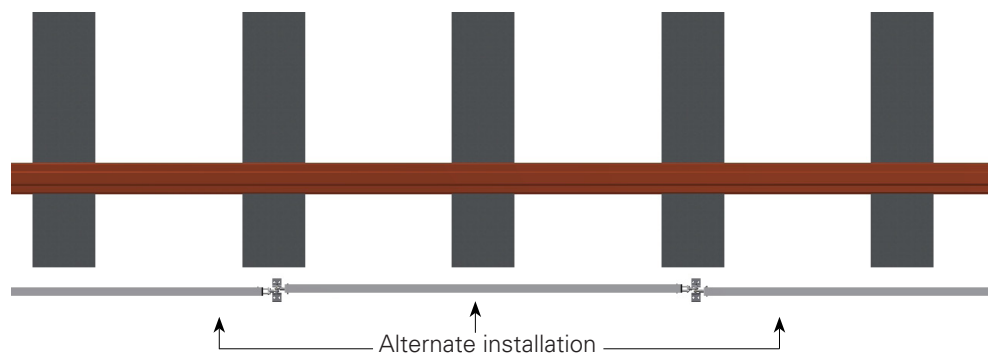
Lay the RDS-L chain along the rail in order to make the junction coincide with the sleepers.

NOTE: Carefully verify that the MALE connector of the last RDS-L of the chain (the fathest from the logger) shall be connected to the terminal resistance or to the last RDS-T gauge.

Set the fixing plates on the sleepers in order to make them coincide with the junctions of the RDS-L chain. Verify the correct alignment before to fix the plates on the sleepers.
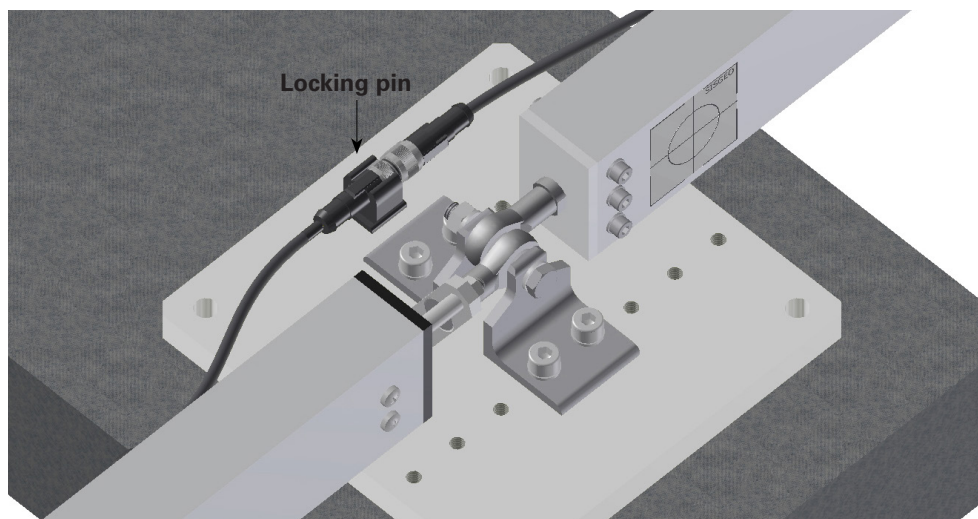
Locking pin

The plates remain fixed to the sleepers, allowing to remove the instruments for rail maintenance, or to monitor other points using new plates.
Fix the junction to the plate, join the connectors and fix them carefully to the locking pin.
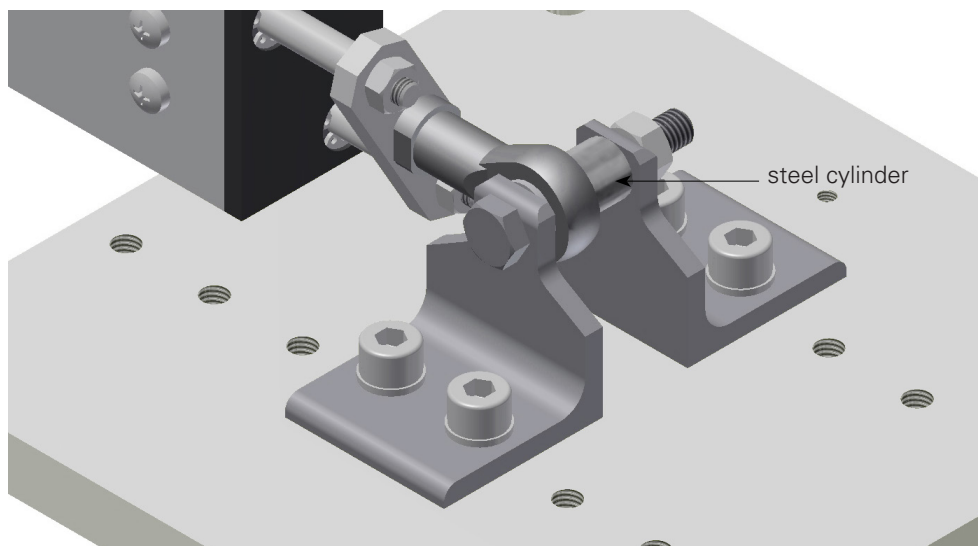
steel cylinder

At the ends of the chain you have to use the special steel cylinder supplied in order to compensate the lack of the near gauge.
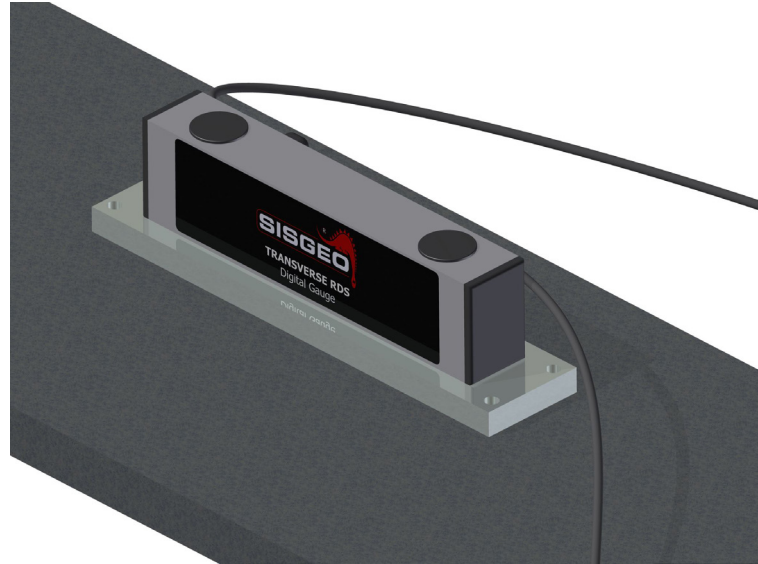
NOTE: RDS-L gauges should be installed horizontally with reference to the orthogonal direction of the gauge (fixing plate should be horizontal). Use the spirit-level to verify it.

NOTE: for wooden crossbeams, Sisgeo supplies a suitable plate, small dimensioned, to be fixed with self-threading screws for wood.

RDS-T GAUGES

The instrument must be placed in the middle of the sleeper, paying attention to the correct alignment.

To remove the instrument from the fixing plate, remove the two black plastic caps and then unscrew the 4 screws.

NOTE: RDS-T gauges shall be installed horizontally with reference to the orthogonal direction of the gauge. Use the spirit-level to verify it.

NOTE: RDS-L and RDS-T gauges can be electrically connected in chain, connectors are fully compatible.

TAKING MEASUREMENTS

The last RDS gauge of every chain (the farest from the logger) must have a termination resistance with value as for the following table. A spare kit of ending resistance is available (product code 0ERESIKIT00 including one 120 Ohm, two 240 Ohm, three 360 Ohm and four 480 Ohm resistances).

Chains connected to the same logger	Resistance value
1	120Ω
2	240Ω
3	360Ω
4	480Ω

Digital RDS are read connecting the terminal cable to the logger (master unit) according to the following table.

	Standard cable	Function	Cable WE606IPDZH
Digital RDS (5 pins connector)	Brown	+Vdc	Red
	Black	GND or -Vdc	Black
	Blue	Data + (RS485 A)	Green
	White	Data - (RS485 B)	Green/White
	Grey	Board protection grounding	Brown + Brown/white
	Shield	Shield	Shield

With RDS we suggest to program the Modbus master (if not supplied from SISGEO) to wait the third reading before to consider it valid.

NOTE: When the cable has reached the datalogger, both the "Shield" and the "board protection grounding" must be connected to a certified ground.

For automatic measures, connect the instrument to a datalogger.
RDS are read connecting the end cable to a portable readout with RS485 interface (DCE, Half duplex, no Echo) able to manage the SISGEO Modbus RTU communication protocol.
The power [W] of power supply must be chosen according to the RDS quantity and power supply mode ("always on" or "timed").
Communication protocol is downloadable from Sisgeo Website (to be used when MODBUS Master is not supplied by SISGEO).
The Modbus master (readout unit) must be set according to the factory's RDS configuration. SISGEO suggests not to change the parameters set in factory (serial number, calibration factors, etc.).

DATA MANAGEMENT

The digital RDS gauges gives reading directly in engineering units (sin alpha, degrees or mm/m). No conversion is needed.

The relative reading refered to the reference measurement can be calculated with the following formula:

$$\Delta L = L_i - L_0$$

where:

ΔL = relative reading
L_0 = Reference reading
L_i = Follow up reading

NOTE: Please refer to APPENDIX 1 for the definishion of "Reference measurement"

NOTE: Reference reading (or reference measurement) shall be taken carefully once the installation is performed, after the stabilization and baseline period, and the instrument is in operating conditions.

NOTE: If the instruments are affected to thermal fluctuation, we strongly suggest to use the WMS Web Monitoring System software platform for data filtering, compensating and analysis.
Please contact your SISGEO sales representative for more information.

TROUBLESHOOTING

Problem	Possible cause	Solution
No RDS gauge is read by Modbus master	Modbus master configuration	Verify the right Modbus master configuration (RS485 interface included)
	Wrong RDS power supply	Verify the correct power and power supply according to the RDS gauge quantities (see F.A.Q.#073 on Sisgeo web site)
Only one RDS gauge can't be read from Modbus master	Modbus master configuration	Verify the right Modbus master configuration (RS485 interface included)
	Electronic board problems	Check the RDS gauge with a SISGEO portable datalogger. Contact SISGEO assistance for replacement if problem persist.
A whole RDS chain can not be read by Modbus master	Short circuit	Check the fuse on the wiring clamps. If it is burned check the cause.
The Modbus master doesn't read the last RDS gauge of the chain	Voltage drop too high	Divide in more than one chain to limit cable lenght or change the powering mode to "Timed"
Unstable measure	Sensor powering not correct	Check that the voltage value is >10V (*)

(*) Correct supply voltage value is between 12 V DC and 24 V DC

MAINTENANCE

After-sales assistance for calibrations, maintenance and repairs, is performed by SISGEO's Customer Care Department.

The authorization for shipment shall be activated by requesting an RMA ticket (Return Manufacturer Authorization).

Please create your account and then fill in the RMA form clicking on:

https://support.sisgeo.com/

Please read carefully the instruction published on Sisgeo's web site.

Send back the instrument/equipment with the complete accessories, using suitable packaging, or, even better, the original ones.

The shipping costs shall be covered by the sender.

Please return to the following address with correct delivery documentation reporting the RMA code received:

SISGEO S.r.l.
Via F.Serpero, 4/F1
20060 MASATE (MI)

Customer Care Department e-mail: ***assistance@sisgeo.com***

APPENDIX 1

DEFINITION OF DISTINCT MEASURING POINTS DURING A GEOTECHNICAL MONITORING PROJECT AS FOR ISO 18674-1

The standard ISO 18674-1 well describe the various measuring points distributed along the project timing. Here below are the description and definition as for the standard:
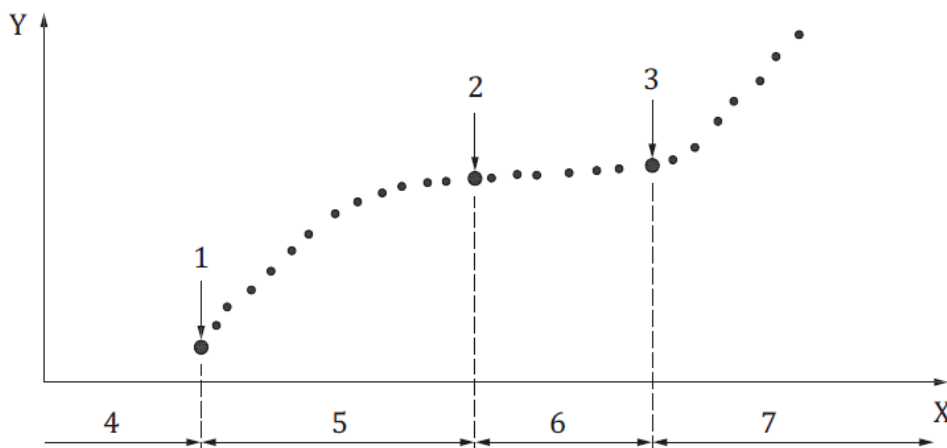
1 - initial measurement: it is the first measurement after installation.

2 - zero measurement: it is the measurement carried out after stabilization of installation effects.
The zero measurement is often taken as reference for subsequent measurements, as it is commonly related to local space and time coordinates.
The zero measurement is commonly carried out with increased measuring effort, e.g. repetition of measurements, to provide a reliable datum for subsequent measurements.

3 - reference measurement: it is a measurement which serves as reference base for previous and subsequent measurements.
The reference measurement is also known as datum measurement.
A new reference measurement is often used for a new construction phase.
The reference measurement is often derived from several measurements.

4 - installation period

5 - stabilization period

6 - period of baseline measurements: measurements carried out, subsequent to the zero measurement, over a period of time before any construction starts, to help in the definition of changes that occur from causes other than construction.
EXAMPLE Seasonal changes in groundwater levels, tidal and moisture content changes, climatic changes such as temperature, and incidence of sunlight.

7 - construction period

X - time
Y - reading