ENCARDIO RITE
METASENSING FOR MEGA STRUCTURES

USERS' MANUAL

EMBEDMENT JOINT METER

Model EDJ-50V

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TUNNELS | HYDROELECTRIC | CONSTRUCTION | STRUCTURAL | METRO & RAIL | BRIDGES | MINING

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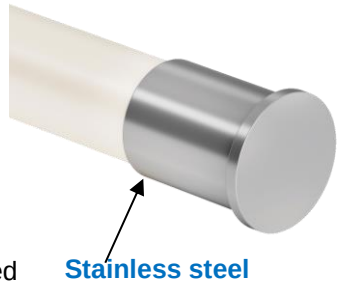
CONTENT

1 GENERAL DESCRIPTION

The Encardio-rite EDJ-50V Vibrating Wire Joint Meter is engineered for precise embedment monitoring of relative displacement across structural joints. Utilizing vibrating wire technology, it provides high-resolution measurements crucial for assessing joint behavior in critical infrastructure. Specifically, the EDJ-50V is instrumental in quantifying contraction joint opening in confined or inaccessible locations, enabling data-driven decisions regarding grout injection timing and volume optimization. Furthermore, it facilitates the analysis of complex structural responses during the construction and long-term monitoring of dams, tunnels, and other large-scale projects.

The EDJ-50V's robust design ensures reliable performance in demanding environments. It comprises a durable, high-impact plastic housing, a fixed stainless steel flange at one end, and a detachable stainless steel socket at the opposing end. The internal vibrating wire displacement transducer, a key component for accurate measurement, is connected to the flange and socket via flexible, articulated joints. These joints accommodate minor lateral movements, mitigating potential stress on the transducer and maintaining measurement integrity. Prior to installation, the stainless steel socket is detached following the procedure outlined in Section 2.1, ensuring proper embedment and alignment.



1.1 Features

- Reliable and accurate.
- Simple to install.
- Simple to read.
- Rugged construction.
- Low cost.
- Versatile datalogging

1.2 Applications

The joint meter is optimized for embedment applications and is designed to measure displacement across joints in structures such as concrete or masonry blocks in dams. It is also suitable for monitoring mass movement in construction, submerged joints in tunnels and shaft linings, and displacements in rock, soil, and masonry structures.

1.3 Conventions used in this manual

WARNING! Warning messages calls attention to a procedure or practice, that if not properly followed could possibly cause personal injury.

CAUTION: Caution messages calls attention to a procedure or practice, that if not properly followed may result in loss of data or damage to equipment.

NOTE: Note contains important information and is set off from regular text to draw the users' attention.

1.4 How to use this manual

This users' manual is intended to provide sufficient information for making optimum use of tape extensometer in various applications.

NOTE: The installation personnel must have a background of good installation practices and knowledge of the fundamentals of geotechnics. Novices may find it very difficult to carry on installation work.

Intricacies involved in installation are such that even if a single essential but apparently minor requirement is ignored or overlooked, the most reliable of instruments will be rendered useless.

A lot of effort has been made in preparing this instruction manual. However, the best of instruction manuals cannot provide for each and every condition in the field, which may affect the performance of the instrument. Also, blindly following the instruction manual will not guarantee success. Sometimes, depending upon field conditions, the installation personnel will have to consciously depart from the written text and use their knowledge and common sense to find solution to a particular problem.

To make this manual more useful we invite valuable comments and suggestions regarding any addition or enhancement. We also request to please let us know of any errors that are found while going through the manual.

This manual is divided into a number of sections. Each section containing a specific type of information.

It is however recommended that you read the manual from the beginning to the end to get a thorough grasp of the subject. You will find lots of unexpected information in the sections you feel you may skip.

2 PRE-INSTALLATION CHECK

The joint meter should be checked for proper operation (including the thermistor) before installation.

CAUTION: The sensor is a delicate and sensitive instrument. It should be handled with care. Twisting or applying too much force on the shaft with respect to the sensor body may result in a zero shift or even permanent damage. Always displace shaft axially while checking or installing sensor.

The shaft end is provided with an alignment pin that sits inside an alignment slot on sensor body. When not in use or while tightening sensor against a shaft mounting object, keep the pin engaged inside the slot to prevent any damage to the sensor by rotation of sensor against shaft body.

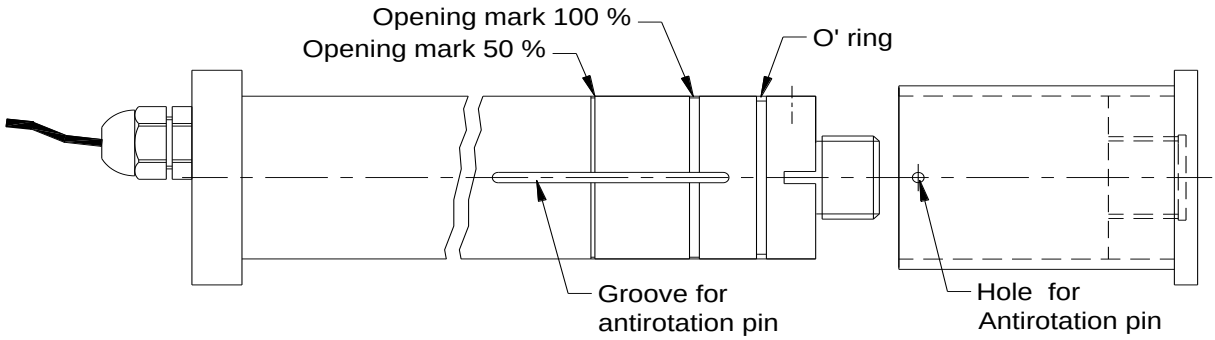
- Check the sensors before installation. Four core signal cable from the sensor has red and black cores for frequency signal; green and white for temperature monitoring through a thermistor. Check working of sensor as follows:
  - Connect sensor to model EDI-54V readout unit. With displacement shaft in retracted position enter sensor constants from Test Certificate and set reading in engineering units at zero mm.
  - Using a 3 mm Allen key, loosen the Allen grub screw, and with a scale, pull the threaded connector by about 5 mm (Do not extend the connector more than the range of the sensor). The readout unit should read around 5 mm. This change in reading ensures proper functioning of displacement sensing system.
  - Check the coil resistance by the digital multimeter, value should lie between 130-180 Ohm.
  - Switch EDI-54V indicator to temperature mode, the displayed temperature should be near to the ambient temperature.

3 INSTALLATION PROCEDURE

Embedment of the joint meter is completed in two stages. During the first stage, the removed stainless steel socket is embedded in one block of concrete (high block). The plastic housing with steel flange which houses the sensor is not embedded at this stage. In the second stage, the joint meter is carefully screwed into the steel socket and elongated to the desired opening and fixed in position using a PVC tape. The outside end of the plastic housing with steel flange is then anchored in concrete by raising the level of the second block of concrete (low block). The cables are carefully laid and guided to the observation room.

3.1 Preparing the instrument for Installation

Joint meter with removed stainless steel socket



2.1.1 **Ensure sensor is in completely closed position.** Remove protective cellophane tape from anti-rotation pin, fixed on stainless steel socket. Remove pin and replace protective tape. Keep the pin carefully as it will be required at the time of installing joint meter.

2.1.2 Hold stainless steel socket in one hand and PVC housing in the other and rotate ten turn anti clockwise. Pull out the housing gently.

CAUTION: Pull or push joint meter rod axially. Never rotate it. Rotating the rod may permanently damage the sensor. A pin has been provided at the end of the joint meter rod that sits flush in a groove in the sensor body. During assembly operation and while using spanners for tightening, keep sensor in closed position with pin seated inside groove such that no torque is exerted on its shaft and there is no rotational movement.

3.2 Embedment of the stainless steel socket in the high block

The stainless steel socket comprises of a cylinder (socket) with an enlarged 62 mm diameter flange at the end which serves to act as a hold fast in the concrete. It is important that the stainless steel socket is installed such that its axis is perpendicular to the contraction/expansion joint in the high block. After determining location of joint meter, following steps are suggested for easy installation of the socket:

2.2.1 Mark position where joint meter is to be installed. It should be around 15 cm below the top of the lift. Raise the lift in the high block to the top leaving a gap of around 0.3 m x 0.3 m x 20 cm deep at the location where the joint meter is to be fixed, demarcating this area with light wooden shuttering.

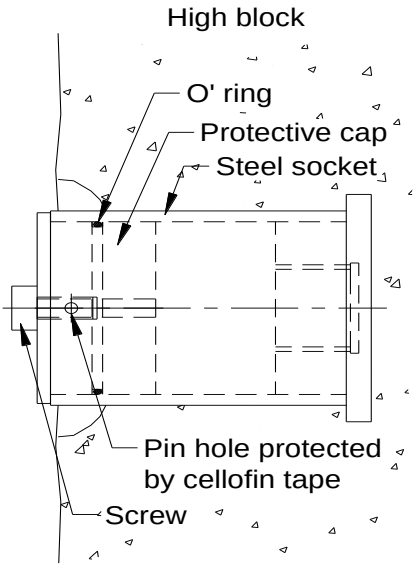
2.2.2 Remove Screw from protective cap and insert cap into stainless steel socket. Ensure 'O' ring is in its place on the protective cap. The 'O' ring prevents grout from entering into socket. Replace screw and tighten. Position the steel socket in the trough such that the face of the steel socket is flushed with the joint face of the high block and its axis perpendicular to the joint face and hole of the anti-rotation pin is on the upper side.

2.2.3 Check the final alignment of the steel socket face. It should be flush with the joint face with the axis perpendicular to the joint face. Make suitable adjustments, if necessary. A spirit level should be used on the surface of the steel socket to check that its axis is in a horizontal plane.

2.2.4 Fill mortar around the socket assembly and complete the high block lift.

2.2.5 Carefully remove 50 mm concrete around the socket face up to a depth of around 20 mm. Let the concrete set for around 48 hours.

2.2.6 Provide a suitable marker for easily locating the embedded socket face.



Installing socket in high block

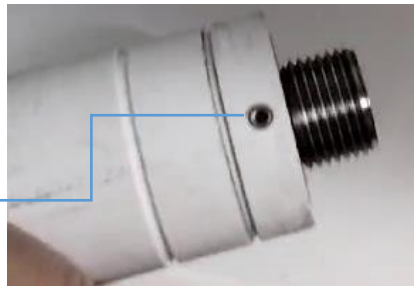
3.3 Installing the joint meter

2.3.1 Installing joint meter in a concrete dam has to be done with perfection. To get proper results, great care has to be taken during installation. Steps involved in placement of joint meter assembly and its installation are as follows:

2.3.2 Proceed with the concreting of the low block until the top of the lift is approximately 20 cm from the elevation where joint meter is to be installed.

2.3.3 Remove protective cap and tape from the stainless steel socket. Demarcate an area of about 1 m x 1 m around the joint meter location on the low block and clean it up. Lay a clean plastic sheet in this area. Exercise care that no dirt enters the stainless steel socket.

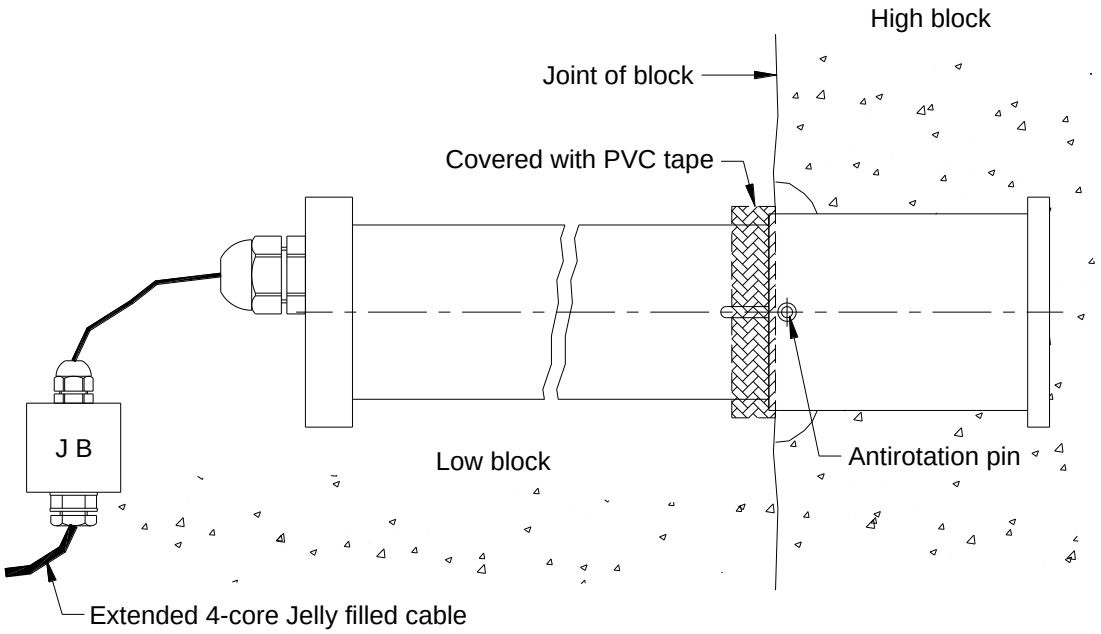
2.3.4 Using a 2.5 mm Allen key, loosen the Allen grub screw to free the shaft for displacement measurements.



2.3.5 Insert joint meter into steel socket. Gently screw joint meter clockwise inside steel socket and tighten it. Do not use force. Groove on the PVC housing will now lie in line with the hole of anti rotation pin. If not, rotate the housing slightly to align them without pulling the joint meter. Insert the pin in the hole and ensure it rests in the groove. Replace the protective tape. Use of spanner or application of excessive torque will damage the joint meter.

CAUTION: Great care should be taken while tightening the joint meter into the steel socket. Application of force while screwing the joint meter into the steel socket will permanently damage it.

2.3.6 Pull the screwed in joint meter to the extent as specified in the design and using tie wires retain it in this position. A mark on the PVC housing is provided at 50% and 100% of the range. However exact amount of pulling can be monitored using the EDI-54V VW read-out logger. Wrap 4-5 turn of PVC tape at the edge of socket on PVC housing to cover the joint.



Installed joint meter across the joint

NOTE: Consult project authorities in case amount of initial offset to be given to the joint meter is not specified. The joint meter must always be mounted somewhat extended to take care of any contraction, which may take place.

2.3.7 Remove plastic sheet from the base of the low block.

2.3.8 Extend the cable of joint meter up to required length by using cable-splicing kit (refer to users manual WI 6002.11).

2.3.9 Lay the cable as required. Check the joint meter reading on the portable digital indicator. The reading should be equal to the initial offset at which the joint meter is set.

2.3.10 Proceed with the concreting of the joint meter to the top of the lift and allow concrete to set in for at least 24 hours. The concrete over the joint meter and the cable should be hand shovelled and mildly vibrated using a hand vibrator. Take care that the joint meter does not get damaged by use of the hand vibrator.

2.3.11 After concreting and at end of the 24 hours period, please again check if displacement reading is all right.

4 TAKING READING

The most important reading is the first reading. It serves as the baseline against which all subsequent measurements are compared.

Conditions prevailing at the time of the initial and subsequent readings — such as temperature, curing stage, elapsed time after placement, and local site conditions — should always be noted in the observation sheet.

Maintaining consistent environmental documentation ensures accurate comparison and reliable interpretation of trends in displacement, stress, or pore pressure over time.

Encardio Rite offers a comprehensive range of data-acquisition systems for vibrating-wire and digital sensors, enabling precise, repeatable, and long-term monitoring.

Depending on project requirements, readings can be taken manually, automatically, or through wireless networked systems.

All solutions are designed for field reliability, ease of operation, and interoperability with both Encardio Rite and third-party sensors.

Manual Readout – EDI-55 Universal Digital Indicator

For on-site verification and short-term measurements, the Encardio Rite Model EDI-55 serves as a portable universal digital indicator.

It directly connects to vibrating-wire and thermistor sensors and displays readings in frequency, period, or engineering units using an intuitive Android-based smartphone interface.

The EDI-55 stores up to 500,000 time-stamped readings and allows quick export via USB or Bluetooth.

Powered by a 6 V rechargeable sealed battery and housed in an IP65-rated splash- and impact-resistant enclosure, the EDI-55 ensures dependable performance in demanding environments.

This device is ideal for spot checks, commissioning, and calibration verification in the field.

Automatic Data Logging – ESDL-30 Datalogger

The Encardio Rite Model ESDL-30 provides a fully automated solution for long-term, unattended monitoring.

It supports a wide range of sensors — including vibrating-wire, thermistor, resistance strain-gage, and MEMS types — via an SDI-12 serial bus interface.

Multiple sensors can be connected in series using a single three-core cable, simplifying site wiring and minimizing installation effort.

Measurement intervals can be programmed from 5 seconds to 168 hours, allowing flexibility to balance data frequency and power consumption.

Data are stored in non-volatile memory and can be accessed locally or remotely through GSM/GPRS/4G telemetry.

Compact, battery-powered, and weatherproof, the ESDL-30 is ideal for dams, metro tunnels, bridges, slopes, and long-term structural monitoring.

Wireless Monitoring – RF Node and Gateway Network

For modern, cable-free installations, Encardio Rite offers a LoRa RF-based wireless monitoring system that enables real-time, low-power, and wide-area data transmission.

The system operates in a STAR configuration, comprising sensor nodes and a central gateway.

Each node connects directly to Encardio Rite sensors and transmits data to the gateway, which uploads it to the Encardio Cloud or Proqio platform for visualization, analysis, and alerting.

Setup and configuration are straightforward using an Android-based device, and the network supports extended battery life for long-term unattended operation.

The wireless system eliminates the need for extensive cabling, simplifies installation, and offers a scalable, robust solution for monitoring large and complex infrastructure such as dams, railways, metro systems, landslide areas, and environmental sites.

By leveraging this technology, owners, consultants, and contractors can achieve real-time visibility into site performance, enhance safety, and reduce project downtime.

For further details and instruction, refer to the corresponding manual(s) at:

https://www.encardio.com/geotechnical-products/dataloggers-gsm-rf

Data Access and Integration

All Encardio Rite data-acquisition systems are designed for interoperability and seamless integration across platforms. Data can be exported in CSV formats, viewed locally, or transmitted to remote servers for centralized management. Through the Proqio dashboards, users can visualize readings, analyze trends, and receive automated alerts for early warnings and decision support.

For further details and instruction, refer to https://www.proqio.com/

4.1 Sample test certificate

ENCARDIO RITE METASENSING FOR MEGA STRUCTURES

TEST CERTIFICATE

Instrument	:	Model EDJ-50V Joint meter Sensor	Date	: 02.03.2025
Serial number	:	XXXX	Temperature	: 26 °C
Capacity	:	50 mm		
Cable Length	:	1 Meter		

Input Displacement (mm)	Observed value Up1 (Digit)	Down (Digit)	Up2 (Digit)	Average (Digit)	End Point Fit (mm)	Poly Fit (mm)
0.00	3038.9	3091.7	3091.7	3065.3	0.00	-0.02
10.00	4280.7	4266.1	4277.2	4279.0	9.99	9.99
20.00	5482.9	5547.1	5526.9	5504.9	20.08	20.11
30.00	6700.9	6730.6	6693.7	6697.3	29.90	29.94
40.00	7912.5	7904.1	7909.3	7910.9	39.89	39.94
50.00	9136.5	9136.5	9140.7	9138.6	50.00	50.05
				Error (%FS)	**0.21**	**0.22**

Digit : $f^2/1000$

Linear gage factor (**G**) : 8.2328E-03 mm/digit

Thermal factor(**K**) : 1.122E-03 mm/°C

Polynomial constants :

A= -2.1060E-09 B= 8.2697E-03 C= -2.5352E+01

Displacement "D" is calculated with the following equation:

Linear : D(mm) =G(R1-R0)-K(T1-T0)

Polynomial : $D(mm) = A(R1)^2 + B(R1) + C - K(T1-T0)-D0$

R1 = current reading & R0 is initial reading in digit.

D0 = Initial reading in mm

Note :

1) Zero reference (initial position) in the field must be established by recording the initial reading R0 (digit) along with temperature T0 (°C) just after installation.

2) Zero displacement reading given in above calibration chart is taken at around 3 mm from mechanical zero, i.e. slider fully in .

Pin configuration/wiring code:

Red & black : Signal **Green & white: Thermistor**

Tested by :

5 ENVIRONMENTAL RESPONSIBILITY DECLARATION

Encardio Rite Group ("**Encardio**") is committed to ensuring full compliance with environmental responsibilities under all applicable Indian environmental statutes, collectively referred to herein as the **"Law(s)"**. This declaration is applicable to all products manufactured and marketed by Encardio.

1. **Scope:** This declaration binds and guides every stakeholder involved in the product's lifecycle including individuals, institutions, organizations, or entities hereinafter referred to collectively as the **"User(s)"**.
2. **Waste Segregation and Handling:** All Users are required to manage the product and any waste generated from its use in accordance with the law, including proper segregation of waste at the source into biodegradable, recyclable, and hazardous categories; authorized disposal of all end-of-life products, electronic components, batteries, and packaging materials only through government-authorized collection, recycling, or refurbishing systems; and ensuring that products bearing the crossed-out wheeled bin symbol are not mixed with general household or municipal waste streams.
3. **E-Waste Disposal and Battery Waste Management:** All electronic and electrical equipment and components manufactured or sold by Encardio must be disposed of only through authorized recycling or refurbishing facilities as per applicable law, ensuring no harm to human health or the environment; users shall ensure that all used items are returned to designated collection points and shall also maintain proper documentation and adhere to return, reporting, or record-keeping obligations; products nearing end-of-life must not be discarded along with general household waste, as improper disposal of e-waste may lead to toxic chemical release and pollution.
4. **Plastic Waste Management:** Users must not discard plastic components or packaging into unsorted municipal waste; instead, they should separate and hand over such plastic waste to authorized waste processors and ensure that no banned plastic items, as notified under law, are used or circulated.
5. **Industrial and Hazardous Waste:** If the User operates any facility where industrial, hazardous, or biomedical waste may arise due to the installation, maintenance, or testing of the product, all necessary consents and permits must be obtained and renewed from competent authorities; adequate protective measures must be taken to ensure no harm is caused to the environment or human health; and such waste must be stored, treated, and disposed of in accordance with the law.
6. **Pollution Control:** Users operating manufacturing, repair, or testing premises must not emit air or water pollutants beyond prescribed limits, must operate only after securing applicable consents under the law, and must maintain environmental records and submit reports as required
7. **Record Keeping and Reporting:** All Users associated with Encardio must maintain comprehensive records of production, sales, collection, and disposal in accordance with applicable Law(s) and submit timely reports to regulatory authorities.
8. **Contact and Support:** Encardio urges all Users to act responsibly and support sustainable environmental practices by adhering to this declaration and the Law. For safe disposal and further compliance assistance, Users are encouraged to contact their local municipal waste authorities, or authorized recyclers. Non-compliance with the above obligations may constitute a violation of Indian environmental laws and attract penalties under the relevant Law(s). Users can contact Encardio at:

Contact Number: +91 522 2661039-42

Website**:** https://www.encardio.com/

6 WARRANTY

The Company warrants its products against defective workmanship or material for a period of 12 months from date of receipt or 13 months from date of dispatch from the factory, whichever is earlier. The warranty is however void in case the product shows evidence of being tampered with or shows evidence of damage due to excessive heat, moisture, corrosion, vibration or improper use, application, specifications or other operating conditions not in control of Encardio-Rite. The warranty is limited to free repair/replacement of the product/parts with manufacturing defects only and does not cover products/parts worn out due to normal wear and tear or damaged due to mishandling or improper installation. This includes fuses and batteries

If any of the products does not function or functions improperly, it should be returned freight prepaid to the factory for our evaluation. In case it is found defective, it will be replaced/repaired free of cost.

A range of technical/scientific instruments are manufactured by Encardio-rite, the improper use of which is potentially dangerous. Only qualified personnel should install or use the instruments. Installation personnel must have a background of good installation practices as intricacies involved in installation are such that even if a single essential but apparently minor requirement is ignored or overlooked, the most reliable of instruments will be rendered useless.

The warranty is limited to as stated herein. Encardio-rite is not responsible for any consequential damages experienced by the user. There are no other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and of fitness for a particular purpose. Encardio-rite is not responsible for any direct, indirect, incidental, special or consequential damage or loss caused to other equipment or people that the purchaser may experience as a result of installation or use of the product. The buyer's sole remedy for any breach of this agreement or any warranty by Encardio-rite shall not exceed the purchase price paid by the purchaser to Encardio-rite. Under no circumstances will Encardio-rite reimburse the claimant for loss incurred in removing and/or reinstalling equipment.

A lot of effort has been made and precaution for accuracy taken in preparing instruction manuals and software. However best of instruction manuals and software cannot provide for each and every condition in field that may affect performance of the product. Encardio-rite neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damage or loss that results from use of Encardio-rite products in accordance with the information contained in the manuals or software.

Products described in Encardio-rite's catalogs are subject to modification and improvement as dictated by subsequent developments. Encardio-rite reserves the right to modify, change or improve products, to discontinue them or to add new ones without notice.