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TQC FE/NFE COATING THICKNESS GAUGE
LD0800

MANUAL

1 PRODUCT DESCRIPTION

This handy, robust and easy to use TQC coating thickness gauge is ideal for measurement tasks in various industries and paint applications. This compact meter allows measurement of painted objects, or other corrosion protective layer thicknesses, with accuracy measured in both Fe (iron or steel) and NFe (aluminum, copper, brass or non-magnetic steel)

1.1 Specifications

Measuring Principe:	F probe = magnetic induction / N probe = eddy currents
Measuring range:	0-1300µm / 0 to 51.2 mils
Accuracy:	±3% + 2µm (0.078 mils)
Resolution:	0µm – 999µm (1µm) / 0 mils – 39.39 mils (0.01 mils) 1000µm – 1300µm (0.01mm) / 39.4 mils – 51.2 mils (0.1 mils)
Calibration:	One point to four points calibration, zero point calibration, basic
Data group:	One direct group (readings not stored in memory) Four general groups (readings will be stored automatically) NOTE: each group has individual statistics, alarm limit settings and calibration
Statistics:	No. of readings, mean, minimum, maximum and standard deviation
Units:	µm, mm and mils
Alarm:	User can set high/low alarm limit, alarm icon displayed on LCD when over limit
Min. curvature radius convex:	1.5mm
Min. curvature radius concave:	25mm
Min. measuring area:	Diameter 6mm
Min. thickness of substrate:	Fe - 0.5mm (0.02") / NFe – 0.3mm (0.012")
Max. Measuring rate:	2 readings p/s
Computer interface:	download data via USB
Power supply:	2 x 1.5V AAA battery
Operation environment:	Temp: 0 to 40°C (32 to 104°F) / Humidity: 20% to 90%
Storage environment:	Temp: -20 to 70°C (-4 to 158°F)
Standard Compliance:	ROHS WEEE
Size:	110mm x 53mm x 24mm (4.33"x 2.09"x 0.94")
Case material:	ABS 92g (3.24oz)

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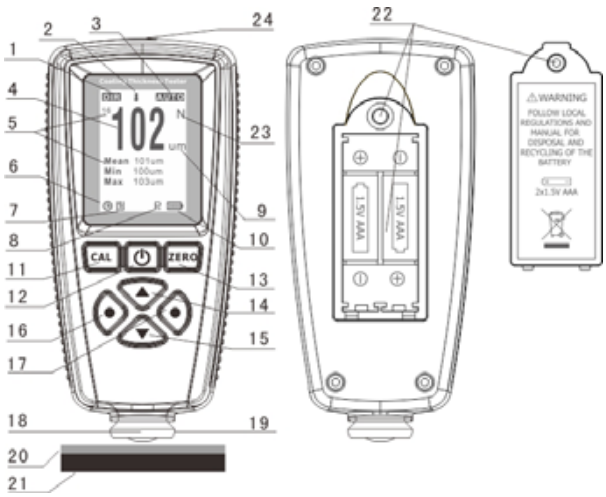
1.2 Details

1 Current work group (DIR and GEN)	13 Zero calibration key
2 High and Low limit alarm ▲▼	14 Up key
3 Probe mode: Auto, Mag, Eddy	15 Down key
4 Measurement readings	16 Left key (menu, select, confirm)
5 Statistics display	17 Right key (cancel, exit, back)
6 Auto power off indicator	18 Probe
7 USB connection indicator	19 V groove
8 Probe instability indicator	20 Standard foil
9 Unit (µm, mm, mils)	21 Substrate
10 Low battery indicator	22 Battery compartment
11 Calibration key	23 Substrate type (F=Fe / N=Nfe)
12 Power ON/OFF key	24 USB interface



2 STANDARDS

ISO 2808

3 WHAT'S IN THE BOX?

TQC Fe/NFe Coating Thickness Gauge
Fe calibration plate
NFe calibration plate
Standard foils
USB cable
2 pcs AAA batteries
Software
Manual
Carrying case

4 PREPARATIONS

When using the instrument for the first time, please read paragraph 5.2

5 PERFORM A MEASUREMENT

5.1. Instrument use

5. 1.1. Replacing the Batteries

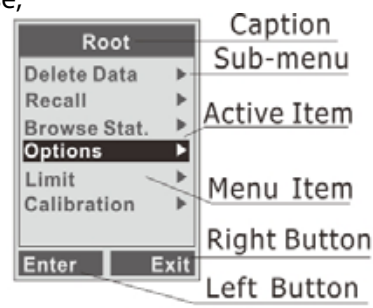
Place the instrument upside down on a suitable surface, remove the screws from the battery compartment with a cross tip screwdriver, raise the lid of the compartment, remove batteries, insert new batteries according to the positive and negative poles, close the lid again and fasten the screw.

5.1.2. Basic Measurement Steps

Step 1: Prepare the sample which needs to be measured.
Step 2: Place the instrument in open space, at least 5cm away from any metal, and press⏻ key to turn on the instrument.
Notes: 1. If is displayed, the batteries are OK. If symbol is displayed, the battery capacity is low, and measurements will not be reliable, In this case please replace the batteries.
2. The instrument will operate in factory default settings for the first time: single measuring mode, AUTO probe

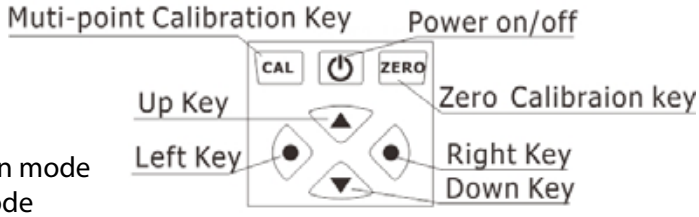
mode, direct group mode (DIR)
3. When turning on the instrument in direct group mode (DIR), the reading display area will be empty. When turned on in general group mode (GENn, n=l to 4), it will display the last readings and statistics measured before the instrument was switched off.
Step 3. Please check paragraph 5.2 to decide whether you need to calibrate the instrument.
Step 4. Start measuring. Place the probe on the sample vertically, and after one beep (for single measuring mode), raise the probe again. Readings will be displayed on the LCD, meanwhile statistics values are upgraded and displayed.
Step 5. Perform next measurement according to step 4.
Step 6. Press ⏻ to power off the instrument. If the instrument is not used over 3 minutes, it will power off automatically.
Note: 1. There are three rank s(P̲ rank 3; P̲. rank 2; P. rank 1) of instability indications for the probe. When P̲ is shown probe is very unstable and there will be no readings until the probe is stable again.
2. If a suspicious reading is displayed, user can delete it through pressing the ZERO key once.
3. Each time you've raised the probe you must wait for about l sec. (holding the probe in open space and 5cm away from metal)

5.1.3. User Interface
The instrument has a standard user interface and is easy to use;
Left Key
a. To enter the menu mode from measuring mode
b. Left button operates in menu mode
("Confirm", "Select", "Delete")
Right Key
a. Right button operates in menu mode
("Cancel", "Back", "Exit")
b. Switching the backlight on/off in measuring mode
Up Key
a. Move up or roll up
b. Increasing
Down Key
a. Move down or roll down
b. Decreasing
Zero Calibration Key Left
a. Press and hold to perform zero calibration in calibration mode
b. Press once to delete current readings in measuring mode
c. Press once to go back to measuring mode while in menu mode
d. Press and hold when instrument is switched on to make a system reset. This will restore factory settings
Calibration Key
a. Press when in calibration mode to go back to measuring mode



a. Menu Mode

b. Measure Mode



c. Key Define

5.1.4. Measuring Mode (Single or Continuous)
- Single measuring mode: Place the probe on the sample vertically, after one beep raise it again. Meanwhile, readings will be shown and statistics will be upgraded and shown.
- Continuous measuring mode: Place the probe on the sample, and don't raise the probe, the measurement will be continuously in a cycle.
- Method to switch to measuring mode:
  a. Press "Left Key" once to enter into menu mode ("Root" directory)
  b. Press "Up Key" or "Down Key" to activate "Measuring Mode" item, and press "Left Key" once to enter
  c. Press "Up Key" or "Down Key" to activate your intended item, and press "Left Key" once to select the item

and to go back.
d. Press "ZERO Key" to go back to the measuring mode. Note: The symbol √ indicates current settings.

5.1.5. Group Mode

- Direct Group (DIR): suitable for quick occasional readings. In this mode, data is temporarily stored in RAM memory, it will be deleted when turning off the instrument. The readings and statistics are shown on the LCD. The RAM can store up to 80 readings. When the RAM is full, measuring will continue but the oldest readings will be deleted by the new readings. Each time new readings are stored, the statistics will be upgraded and visible.
- General Group (GENn, n=l to 4): In this mode, data is stored into the instrument memory and not lost when turning off the instrument. The memory can store up to 80 readings. When the memory is full, measuring will continue but the symbol "fl" will appear on the left side of the readings, the new readings will not be stored, and statistics will not be upgraded.
  NOTE: Each group (DIR or GEN) has an individual high/low limit alarm and zero calibration and multi-point calibration, these settings will be stored into the memory when user changes them.
- Method to switch to group mode:
  a. Press "Left Key" once to enter into menu mode ("Root" directory)
  b. Press "Up Key" or "Down Key" to activate "Options" item, and press "Left Key" once to enter
  c. Press "Up Key" or "Down Key" to activate "Group Mode" item, and press "Left Key" once to enter
  d. Press "Up Key" or "Down Key" to activate your intended item, and press "Left Key" once to select the item and go back. Press "ZERO Key" to go back to measuring mode.

5.1.6. Statistics

The instrument calculates the statistics for stored readings of each group independently, including minimum, maximum and standard deviation. In direct group mode, when RAM is full, the oldest readings will be deleted, the new readings will be stored, and statistics will be upgraded. In the general group mode, when the memory is full, new readings will not be stored and the statistics won't be upgraded. If specified or whole group readings are deleted, the statistics will also be upgraded.

- The statistics will be displayed on the LCD in default. You can choose to hide or show them it through below mentioned method;
  a. Press "Left Key" once to enter into menu mode ("Root" directory)
  b. Press "Up Key" or "Down Key" to activate "Options", and press "Left Key" once to enter
  c. Press "Up Key" or "Down Key" to activate "Display Stat.", and press "Left Key" once to enter
  d. Press "Up Key" or "Down Key" to activate your intended item, and press "Left Key" once to select the item and go back. Press "ZERO Key" to go back to measuring mode.
- Browse the statistics through menu:
  a. Press "Left Key" once to enter into menu mode ("Root" directory)
  b. Press "Up Key" or "Down Key" to activate "Browse Stat.", and press "Left Key" once to enter
  c. Press "Right Key" once to go back. Press "ZERO Key" to go back to measuring mode.

5.1.7. Probe Modes

There are three different probe modes: AUTO, MAG and EDDY. In AUTO mode, the probe can automatically determine the type of substrate measured. In MAG mode, the probe can only measure on magnetic substrates. In EDDY mode, the probe can only measure on non-ferrous metal substrates. When a magnetic substrate is detected, an "F" will be shown on the right side of the readings, and when a non-ferrous metal is detected, an "N" will be shown. User can switch probe modes as below;
a. Press "Left Key" once to enter into menu mode ("Root" directory)
b. Press "Up Key" or "Down Key" to activate "Options" item, and press "Left Key" once to enter
c. Press "Up Key" or "Down Key" to activate "Probe Mode" item, and press "Left Key" once to enter

d. Press “Up Key” or “Down Key” to activate your probe mode, and press “Left Key” once to select the item and to go back. Press “ZERO Key” to go back to measuring mode.

5.1.8. Storage

In general group mode (GENn), readings and statistics will be stored and not lost when you turn off the instrument. In direct group mode (DIR), readings and statistics will be lost when turning off the instrument. Each group has an individual high/low limit alarm, zero calibration and multi-point calibration, user can change these settings, which will be stored.
In addition, you can also set the system settings (Measuring Mode, Group Mode, Probe Mode etc.), these settings will also be stored.
Note: When the battery capacity is low, user must replace the batteries in time. Before replacing the batteries, please turn off the instrument.

5.1.9. Recall and Delete Readings

- Delete the last readings (Tip: in measuring mode, press the “ZERO Key” once)
  a. Press “Left Key” once to enter into menu mode (”Root” directory)
  b. Press “Up Key” or “Down Key” to activate “Delete Data”, and press “Left Key” once to enter
  c. Press “Up Key” or “Down Key” to activate” Current Data”, and press “Left Key” once. A dialog box will be displayed.
  d. Press “Left Key” once to confirm the selection and go back, or “Right Key” to cancel and go back. Press “ZERO Key” to go back to measuring mode.
- Delete whole group readings
  a. Press “Left Key” once to enter into menu mode (”Root” directory)
  b. Press “Up Key” or “Down Key” to activate “Delete Data”, and press “Left Key” once to enter
  c. Press “Up Key” or “Down Key” to activate “Current Group”, and press “Left Key” once. A dialog box will be displayed.
  d. Press “Left Key” once to confirm the selection and go back, or “Right Key” to cancel and go back. Press “ZERO Key” to go back to measuring mode.
- Recall and delete specified readings
  a. Press “Left Key” once to enter into menu mode (”Root” directory)
  b. Press “Up Key” or “Down Key” to activate “Recall”, and press “Left Key” once to enter
  c. Press “Up Key” or “Down Key” to recall the readings (n/Total number, “n” indicates the index of current shown readings). User can press “Left Key” to delete current shown readings.
  d. Press “Right Key” to go back. Press “ZERO Key” to go back to measuring mode.

Note: When readings are deleted, the statistics will be upgraded automatically.

5.1.10. High and Low Limit Alarm

Each group has individual high/low limit alarm settings. When switching to the work group, the applied alarm settings will also be switched automatically.

- Set high/low limit for the current work group as below;
  a. Press “Left Key” once to enter into menu mode (”Root” directory);
  b. Press “Up Key” or “Down Key” to activate “Limit”, and press “Left Key” once to enter
  c. Press “Up Key” or “Down Key” to activate “Settings”, and press “Left Key” once to enter
  d. Press “Up Key” or “Down Key” to activate your intended item, and press “Left Key” once to enter
  e. Press “Up Key” or “Down Key” to increase or decrease the limit value. If the key is hold, the limit value will be increased or decreased continuously.
  f. Press “Left Key” to confirm new limit value, or “Right Key” to cancel and go back. Press “ZERO Key” to go back to measuring mode.
- Clear high/low limit
  a. Press “Left Key” once to enter into menu mode (”Root” directory)

b. Press “Up Key” or “Down Key” to activate “Limit”, and press “Left Key” once to enter
c. Press “Up Key” or “Down Key” to activate “Clear”, and press “Left Key” once. A dialog box will be displayed.
d. Press “Left Key” once to confirm the selection and go back, or “Right Key” to cancel and go back. Press “ZERO Key” to go back to the measuring mode.
Note: When readings exceed the high limit, the alarm symbol ↑ will appear on the LCD, and when readings exceed the low limit, the alarm symbol ↓ will appear.

5.1.11. Unit
It is possible to choose 3 different measurement units (µm, mm and mils) for readings. Switch to your requested unit as follows:
a. Press “Left Key” once to enter into menu mode (”Root” directory)
b. Press “Up Key” or “Down Key” to activate “Options”, and press “Left Key” once to enter
c. Press “Up Key” or “Down Key” to activate “Unit Settings”, and press “Left Key” once to enter
d. Press “Up Key” or “Down Key” to select the needed unit. Press “Left Key” to confirm it.

5.1.12. Backlight
In dim light, the LCD backlight can be activated. The backlight will accelerate battery consumption. While in measuring mode, press “Right Key” once to switch on/off the backlight. In menu mode, switch it as below;
a. Press “Left Key” once to enter into menu mode (”Root” directory)
b. Press “Up Key” or “Down Key” to activate “Options”, and press “Left Key” once to enter
c. Press “Up Key” or “Down Key” to activate “Backlight”, and press “Left Key” once to enter
d. Press “Up Key” or “Down Key” to select on or off. Press “Left Key” to confirm your choice.

5.1.13. Data Download
The supplied USB cable can be used to connect the instrument with a computer to download stored readings. If USB connected, the symbol will appear on the bottom of the LCD. When you make the USB connection for the first time, the driver and software for this application needs to be installed onto your computer.

5.1.14. Auto Power off
The instrument can be turned off by pressing the ⏻ key manually. In addition, for saving power, the instrument will turn off automatically if no operation occurs within 3 minutes. Before turning off automatically, you will hear several beeps, by pressing any key during these beeps, the instrument will restart timing and continue working. Enable or disable this function as below;
a. Press “Left Key” once to enter into menu mode (”Root” directory)
b. Press “Up Key” or “Down Key” to activate “Options”, and press “Left Key” once to enter
c. Press “Up Key” or “Down Key” to activate “Auto Power off”, and press “Left Key” once to enter
d. Press “Up Key” or “Down Key” to select Disable or Enable. Press “Left Key” to confirm your choice.

5.1.15. Measurement Accuracy
For factors which may affect the accuracy of measurements, please check paragraph 5.2. Under normal use and careful calibration, all subsequent measurements will lie within the guaranteed measuring tolerance.
When using the statistics programmer for obtaining a mean value it is advisable to place the probe several times at a chosen measuring spot or at fixed measuring spot. Any false readings can be deleted immediately. The final reading derives from the statistical calculation and from the guaranteed tolerance levels of the instrument. T (coating thickness) = M (mean value) ± S (standard deviation) ± A (measuring accuracy)

5.2 Factors affecting accuracy

There are some factors which might affect the measurement's accuracy. These factors are listed as below;

Factor/principal	Magnetic	Eddy current	Recommendations
Magnetic samples	√		Calibration needed
Electrical samples		√	Calibration needed
Curvature radius	√	√	Please read paragraph 1.1 + calibration needed
Substrate thickness	√	√	Please read paragraph 1.1 + calibration needed
Size of measuring area	√	√	Please read paragraph 1.1 + calibration needed
Surface roughness	√	√	
Position and shape	√	√	
Sample deformation	√	√	Avoid measuring on too soft or too thin materials
Adhesive substances	√	√	Clean probe and sample
Strong magnetic fields	√		Keep away from strong magnetic fields
Temperature & Humidity	√	√	Re-calibrate at the same environment conditions
Measuring operations	√	√	Please read paragraph 5.1.2.
Low batteries	√	√	Please replace the batteries
Probe wear	√	√	Please contact supplier

The measured sample must have the same conditions as the calibration sample (material properties, curvature radius) The more closely the measured sample matches the calibration sample, the more accurate the readings will be. In addition, curvature radius should meet the minimum value as specified in paragraph 1.1.

The minimum substrate thickness and the minimum measuring area as specified in chapter 1.2 should be taken into account. The instrument needs to be re-calibrated (Zero/Multi-point) if measuring various samples for higher accuracy.

To achieve high-accuracy readings, it is advisable to log calibration values several times. In this way, the instrument will automatically establish a mean calibration value. The high-accuracy calibration is an obvious advantage when calibrating uneven and rough surfaces.

The point at which a measurement is made should always be similar with the calibration point, especially in the case of corners and edges of small parts.
Important Note: The enclosed substrates are intended for checking accuracy only and not for calibration purposes. User must recalibrate the instrument according to practical applications.

5.3 Calibration

Please check the table in chapter 5.2 firstly, re-calibrate the instrument according to the measured product sample. The instrument provides basic calibration, zero calibration and multi-point calibration.

- Basic calibration: Also the factory default calibration; can only be used for measurements on even surfaces and if the object has the same material, curvature, and size as the factory provided substrates. For more details, please consult with your supplier.
- Zero calibration: Recommended if measuring errors occur up to ± (3%+2um).
- Multi-point calibration: The allowed measuring deviation will be max. ± (1~3%+2um). One point calibration, Is only recommended if the readings are expected to be close to the calibration value. Several points calibration is recommended when measuring on rough surfaces or for precise measurements on smooth surfaces if the expected thickness lies between that of the calibration point.

5.3.1. Zero Calibration

a. In measuring mode, press "CAL key" once to enter into calibration mode.
b. Place the probe on the uncoated sample and raise it after one beep. The LCD will show "X".
c. Press and hold "ZERO Key" until hearing 3 beeps. The LCD will show "0" and "ZERO" symbol.
d. Repeat step b and c several times to obtain mean value.
e. When finished. Press "CAL Key" to exit calibration mode.

5.3.2. Multi-point Calibration

a. In measuring mode, press "CAL key" once to enter into calibration mode.
b. Zero calibration according to chapter 5.3.1. afterwards place the calibration foil on an uncoated sample.
c. Place the probe and raise it after one beep. A reading will be displayed. Press "Up Key" or "Down Key" to increase or decrease the reading or hold the key for changing continuously until the required foil thickness value is shown. The LCD will show current calibration point "Ptn X ". The "X" will be flashing.
d. Place the probe on the test sample for several times, raise the probe each time you replace it, then press "CAL Key", after "3 beeps", it will display a mean value for the current calibration point.
e. Press "Left Key" to confirm and end current calibration point, the "X" will be steady. Or press "Right Key" to cancel and end current calibration point.
f. For more calibration points, use another calibration foil and repeat steps c, d and e.
g. When finished. Press "CAL Key" to exit calibration mode.
Note:
-Each group has individual zero calibration and multi-point calibration.
-When calibration up to 4 points, user must clear the finished points firstly to restart.
-Readings measured before will not be affected by new calibration.
-In calibration mode, measuring will not be affected.
-Recommended to work in single measuring mode when calibrating.

5.3.3. Shot-blasted Surfaces

The physical nature of shot-blasted surfaces results in coating thickness readings that are too high. The mean thickness over the peaks can be determined as follows.
Method one:
a. The instrument should be calibrated according to 5.3.2. (one or more points calibration). Use a smooth calibration sample with the same curvature radius and the same substrate as the sample to be measured.
b. Take approx. 10 readings on the uncoated, shot-blasted sample to produce the mean value A.
c. Take approx. 10 further readings on the coated, shot-blasted test sample to produce the mean value B.
d. The coating thickness T = (B-A) ± S. The "S" is the highest standard deviation of step b and step c.
Method two:
a. The instrument should be calibrated according to paragraph 5.3.2. (one or more points calibration) on the shot-blasted sample.
b. Take approx. 10 readings of the test sample to calculate a mean value which can be used as final coating thickness.

5.3.4. Clear Calibration

The calibration can be cleared to start new applications. When there is an incorrect calibration, it should also be cleared.
a. Press "Left Key" once to enter into menu mode ("Root" directory)
b. Press "Up Key" or "Down Key" to activate "Calibration" item, and press "Left Key" once to enter .
c. Press "Up Key" or "Down Key" to activate "Clear All" item (Note: you can also clear only part of them, please see the menu for details), and press "Left Key" once. A dialog box will be displayed.
d. Press "Left Key" once to confirm the selection and go back, or "Right Key" to cancel and go back.
Note: All operations are limited within current work group, the other groups will not be affected.

5.4 Trouble Shooting

If the instrument does not response or can't be turned on, you can remove the batteries, reinstall them a few minutes later and try again. If the problem remains, please contact your supplier for help.

The following errors should be solved by a system reset:
-Illogical readings
-Several of the keys don't work

System reset:
1. Turn off the instrument.
2. Press and hold "ZERO Key" and then turn on the instrument.
3. Release the "ZERO Key" until a dialog box of the system reset is shown on the LCD.
4. Press "Left Key" to confirm system reset. The instrument will restart automatically.

6 CALIBRATIONS

We recommend annual calibration. For calibration, send the instrument, together with a RMA form* to TQC, Molenbaan 19, 2908 LL Capelle aan den IJssel, NL.

*You can download the RMA form here: http://www.tqc.eu/en/service/repairs-calibrations/

7 REPLACING BATTERIES

Place the instrument upside down on a suitable surface, remove the screws from the battery compartment with a cross tip screwdriver, raise the lid of the compartment, remove battery, insert new battery according to the positive and negative poles and close the lid and fasten with screws.

8 MAINTENANCE

- Though robust in design, this instrument is precision-machined. Never drop it or knock it over
- Always clean the instrument after use.
- Clean the instrument using a soft dry cloth. Never clean the instrument by any mechanical means such as a wire brush or abrasive paper. This may cause, just like the use of aggressive cleaning agents, permanent damage.
- Do not use compressed air to clean the instrument.
- Always keep the instrument in its case when not in use.
- We recommend annual calibration

9 DISCLAIMER

The right of technical modifications is reserved.

The information given in this manual is not intended to be exhaustive and any person using the product for any purpose other than that specifically recommended in this manual without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at his own risk. Whilst we endeavour to ensure that all advice we give about the product (whether in this manual or otherwise) is correct we have no control over either the quality or condition of the product or the many factors affecting the use and application of the product. Therefore, unless we specifically agree in writing to do so, we do not accept any liability whatsoever or howsoever arising for the performance of the product or for any loss or damage (other

than death or personal injury resulting from our negligence) arising out of the use of the product. The information contained in this manual is liable to modification from time to time in the light of experience and our policy of continuous product development.

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