# Magnescale

Display Unit
# LT80-NE

Read all the instructions in the manual carefully before use and strictly follow them.
Keep the manual for future references.
This manual corresponds to the software version Ver 1.04.00.
This manual describes only the added and changed functions compared to the software version
Ver 1.02.00, so be sure to also read the software version Ver 1.02.00 Operating Manual.

## Operating Manual

# Functions added by V1.04.00

LT80-NE software version V1.04.00 adds and changes the following functions compared to V1.02.00.

> • The number of data that can be saved in the LT80-NE (display unit) has been expanded from 100,000 data to 300,000 data.
> • The data save format can be selected.

The MG80-NE (latch module) is supported.
The Operating Manual for the operation method is contained herein.

# 1. Measurement data save format

The following date and time formats and Decimal points can be selected for the format when saving measurement data in an external memory.

• Data menu (when reading measurement data)
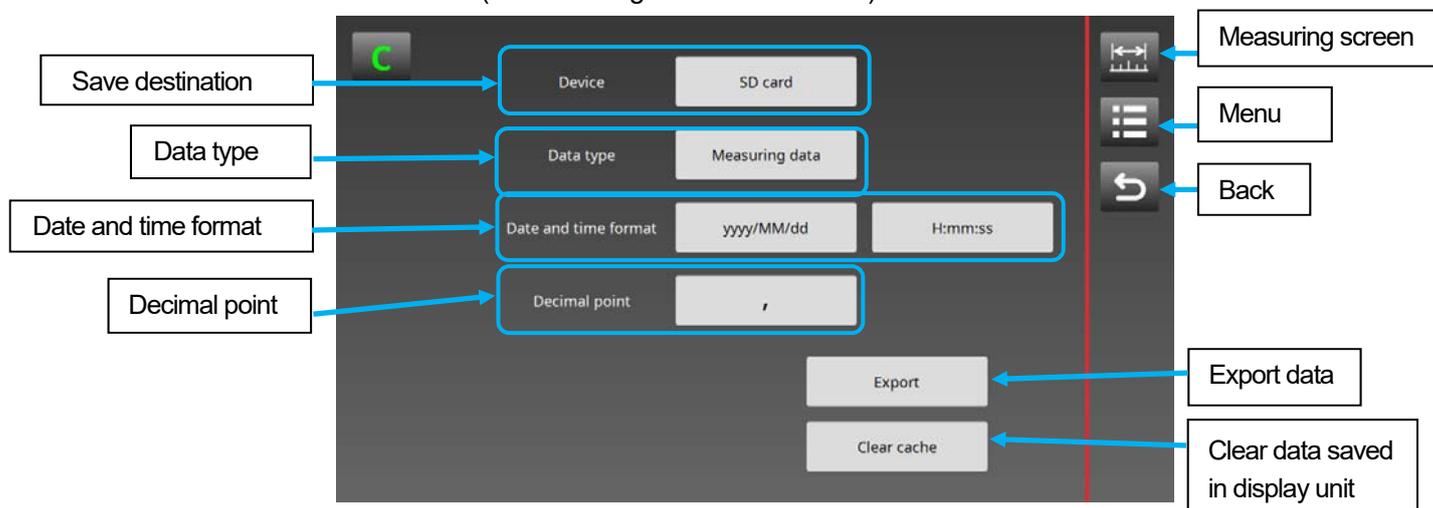


• Examples of selectable date and time formats

| Date format | Example of display |
|---|---|
| yyyy/MM/dd | 2019/06/13 |
| yyyy.MM.dd | 2019.06.13 |
| MM/dd/yyyy | 06/13/2019 |
| MM.dd.yyyy | 06.13.2019 |
| dd/MM/yyyy | 13/06/2019 |
| dd.MM.yyyy | 13.06.2019 |

| Time format | Example of display |
|---|---|
| H:mm:ss | 13:57:09 |
| h:mm:ss AP | 1:57:09 PM |

• Selection of Decimal points

Dot — Decimal point    .          Comma — Decimal point    ,

* The delimiter in the data format is a comma (,) when dot is selected or a semicolon (;) when comma is selected.

• Clear data saved in display unit
This clears the data saved in the LT80-NE and resets the saved data counter in the measuring screen to zero.

## 2. Overview of MG80-LM Latch Module

The MG80-LM can be used to obtain measurement values in synchronization with an angle or position signal (AB quadrature signal) from an encoder or other device.
The obtained measurement values are saved in the LT80-NE (display unit), so the data can be exported to an external memory and checked, saved, and edited using a computer or other device.
Up to 300,000 data can be saved in the LT80-NE.
When Latch mode is set to "Encoder" or "Encoder (High-speed)" and the number of saved data exceeds 300,000 data, latch operation stops and the 300,000 data are held.

The connection configuration when using the MG80-LM is limited as follows.

- Only one MG80-MA (main module) can be connected to the LT80-NE.
- Only one MG80-LM (latch module) can be connected to the MG80-MA.
- Up to 16 MG80-CM (counter module) can be connected to the MG80-MA.
- Up to two LZ80-K (I/O module) can be connected to the MG80-MA.
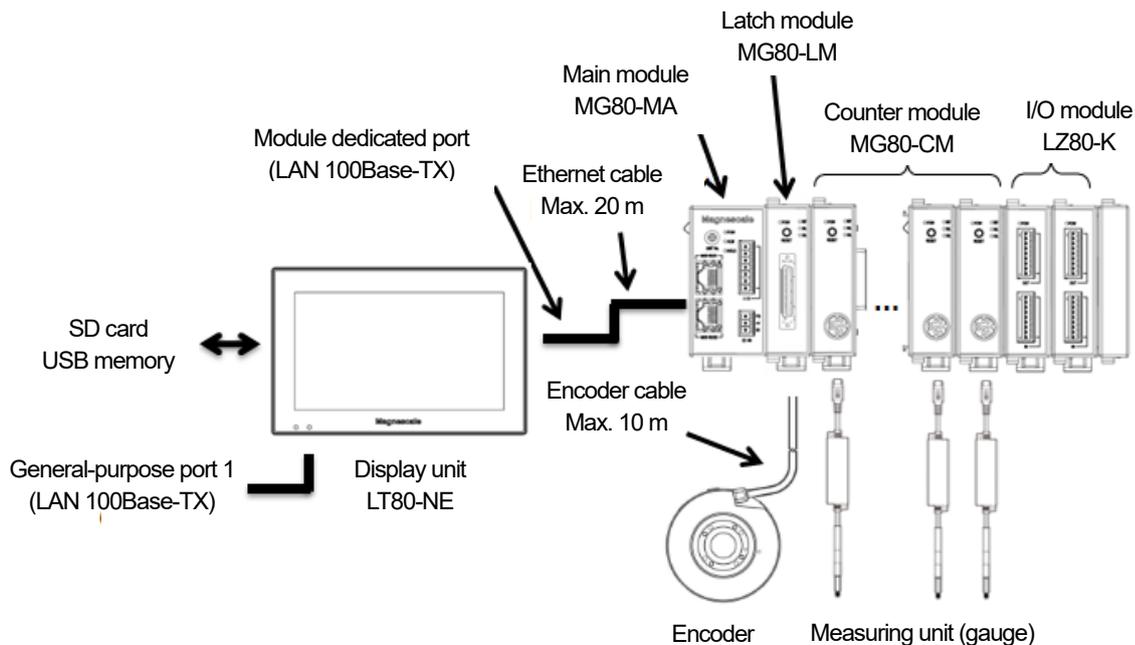  (The LZ80-K cannot be used when Latch mode is "Encoder (High-speed)".)

The MG80-LM supports the following MG80-MA and MG80-CM versions.
Check the serial numbers of your products, and contact our sales representative if you have any non-applicable products.
    MG80-MA: Serial numbers 200001 and higher
    MG80-CM: Serial numbers 200001 and higher

**Connection configuration**

## • Overview of operation

In a standard system, measurement data is acquired at an arbitrary timing generated inside the main module. However, the MG80-LM can be used to acquire measurement data at the timing of an output signal from another measuring device (rotary encoder or linear encoder).
This enables to acquire measurement data in synchronization with the specified position (angle or length), even if the encoder speed is uneven, etc.
The signals that can be input to the MG80-LM are voltage differential type AB quadrature signal, reference point signal.
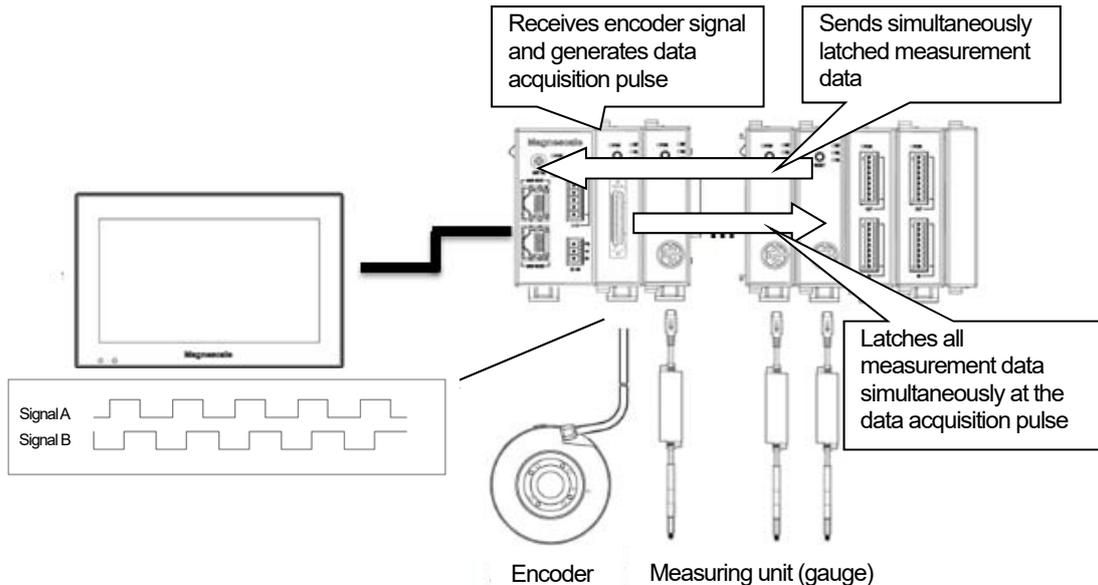


The MG80-LM generates the data acquisition pulse based on the AB quadrature signal of the encoder signal and outputs it simultaneously to all MG80-CM (counter module) units.
The MG80-CM units latch the measurement data of the measuring unit at the data acquisition pulse and output the data.

The minimum interval time of the data acquisition pulse is 400 μs in Encoder mode and 100 μs in Encoder (High-speed) mode.

## • Data acquisition pulse settings

Make the following settings to determine the data acquisition pulse interval.

Encoder settings: Resolution, AB quadrature signal multiplication, and count direction of the encoder connected to the MG80-LM

Offset settings: Reference point used/not used for data acquisition start timing
Data acquisition start timing offset amount (angle or length)

Latch condition settings: Latch direction (Latch on/off relative to encoder movement direction)
Latch count, count of latch interval (Number of encoder reference pulses)
Latch interval (angle or length)

4

## 2-1. Encoder connected to the MG80-LM

The MG80-LM supports voltage differential (EIA-422) AB quadrature signal, reference point signal output encoders.
Note that it is not necessary to use the reference point signal. (An encoder without reference point signal output can also be used.)

The encoder power supply is 5 V, 500 mA, and power can be supplied from the encoder input connector of the MG80-LM.
When using an encoder that requires power supply other than 5 V, prepare a separate power supply.
Refer to the Instruction Manual included with the MG80-LM for the connection method and specifications.

## 2-2. Setting items and contents

When using the MG80-LM, make the settings with the LT80-NE (display unit).

• Latch mode
This sets the latch mode.
The latch interval is related to the AB quadrature signal multiplier setting, the count of latch interval, and the encoder movement speed, and becomes narrower as the movement speed increases.
An error occurs when a latch interval less than the minimum latch interval time is detected.

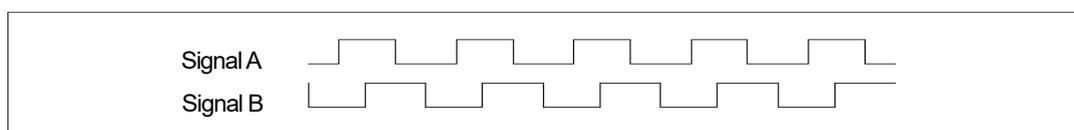| Item | Description |
|---|---|
| Internal | This disables the MG80-LM functions. This is the standard mode. |
| Encoder | Minimum latch interval: 400 µs |
| | Measuring unit reference point, calculation, comparator, and I/O functions are available. |
| Encoder (High-speed) | Minimum latch interval: 100 µs |
| | Measuring unit reference point operations, and inter-frame calculation, display mode, preset comparator, and I/O functions are not available. |

• Encoder setting
This makes the settings for the encoder connected to the MG80-LM.
Set in accordance with the encoder used.

| Item | Description |
|---|---|
| Encoder type | This selects "Linear" or "Rotary". |
| Resolution | Use the numerical keypad to enter the output resolution of the connected encoder. |
| Direction | This sets "+" or "-" as the encoder count direction. |
| Multiplication | Selects "1", "2" or "4" as the AB quadrature signal multiplier of the connected encoder. |
| | Select "1" when the one cycle of the AB signal is one resolution unit. |
| | Select "4" when the phase difference between the signal A and signal B is one resolution unit. |

When the count direction is set to "+", the latch counter counts in the plus direction with the signal A of the AB quadrature signal advanced.
When Direction is set to "+" with the following AB quadrature signal (Signal A advanced), this is the plus direction.

• Latch start condition settings

This sets the latch operation start timing.

| Item | Description |
|---|---|
| Reference point | Reference point used/not used.<br>When reference point not used is set, latch operation starts when the measurement start button in the measuring screen (or the I/O connector of the display unit) is pressed. When reference point used is set, latch operation starts from the position where the reference point was detected. |
| Offset count | Use the numerical keypad to enter the data loading start position or the offset value from reference point acquisition. |
| Offset length | Use the numerical keypad to enter the offset length angle or length.<br>When this is set, latch operation starts when that offset length is reached. |

When either Offset count or Offset length is entered, the other will be automatically set.

• Latch condition settings

This sets the latch conditions.

| Item | Description |
|---|---|
| Latch direction | This sets the direction of the latch counter used to perform latch.<br>This is the movement direction setting of the encoder used to perform latch. The available settings are "+ direction", "- direction" and "Bidirectional".<br>When set to "+ direction" or "- direction", latch operation is not performed at positions that the encoder has already passed. Use these settings when the encoder moves in the opposite direction due to vibration or other factors, but latch operation is to be performed in only the same direction.<br>When set to "Bidirectional", latch operation is performed at all set timings.<br>**Note:** The position will not be detected immediately after the direction is reversed. Refer to the figure below. |
| Number of latch | Use the numerical keypad to enter the latch count. |
| Count of latch interval | Use the numerical keypad to enter the count of latch interval.<br>Examples: Enter "1" to latch at each AB quadrature signal pulse.<br>Enter "10" to latch every 10 pulses. |
| Latch interval | Use the numerical keypad to enter the latch interval angle or length. |

When either Count of latch interval or Latch interval is entered, the other will be automatically set.

Operation status when Latch direction is set to "+"
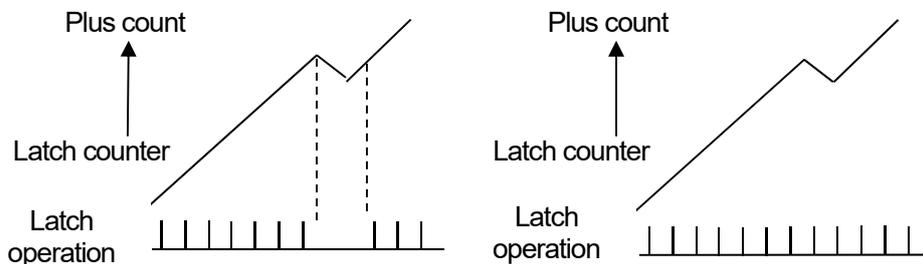


When set to "+ direction", latch operation is not performed in the - direction or at positions that have already been passed.

When set to "Bidirectional", latch operation is performed at all timings.

## 2-3. Latch module setting method

After setting each item in the Measuring unit settings screen, follow the procedure below and make the Latch module settings.
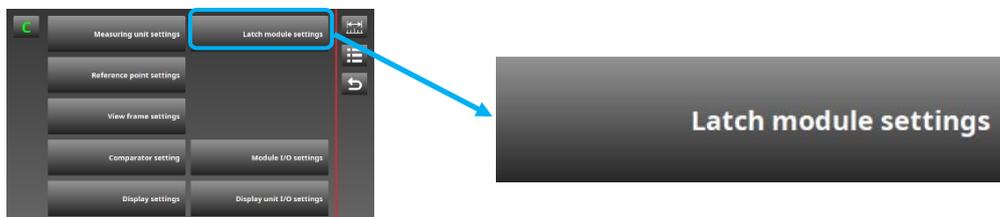


Measuring menu

This item is the connected encoder specifications and latch interval settings when using the MG80-LM (latch module).
(This menu is available only when using the MG80-LM.)

Setting contents: Encoder mode, encoder type, resolution, direction, multiplication, reference point, offset value, number of latch, latch interval

Factory settings: When Latch mode is switched from "Internal" to "Encoder" or "Encoder (High-speed)"

| Item | Factory setting |
|---|---|
| Latch mode | Encoder or Encoder (High-speed) |
| Encoder type | Rotary |
| Resolution [P/R] | 1000 |
| Direction | + |
| Multiplication | 1 |
| Reference point | × |
| Offset count | 0 |
| Offset angle [deg] | 0 |
| Latch direction | Bidirectional |
| Number of latch | 1000 |
| Count of latch interval | 1 |
| Latch interval [deg] | 0.36 |

・Encoder type "Rotary" selection screen

| Encoder type | Resolution | Latch mode | Direction | Multiplication |

**Latch mode** — Encoder

Measuring screen

Menu

Back

**Encoder settings**

| Encoder type | Resolution (P/R) | Direction | multiplication |
|---|---|---|---|
| Rotary | 1,000 | ✚ | 1 |

**Latch start condition settings**

| Reference point | Offset count | Offset angle (deg) |
|---|---|---|
| ✗ | +83 | +29.8800 |

Reference point

Offset count

Offset angle (deg)

Monitor

**Latch condition settings**

| Latch direction | Number of latch | Count of latch interval | Latch interval (deg) |
|---|---|---|---|
| By direction | 1,000 | 1 | 0.3600 |

Latch direction | Number of latch | Count of latch interval | Latch interval (deg)

・Encoder type "Linear" selection screen

| Encoder type | Resolution | Latch mode | Direction | Multiplication |

**Latch mode** — Encoder

Measuring screen

Menu

Back

**Encoder settings**

| Encoder type | Resolution (um) | Direction | multiplication |
|---|---|---|---|
| Linear | 0.1 | ✚ | 1 |

**Latch start condition settings**

| Reference point | Offset count | Offset length (mm) |
|---|---|---|
| ✗ | +0 | +0.0000 |

Reference point

Offset count

Offset length (mm)

Monitor

**Latch condition settings**

| Latch direction | Number of latch | Count of latch interval | Latch interval (mm) |
|---|---|---|---|
| By direction | 1,000 | 1 | 0.0001 |

Latch direction | Number of latch | Count of latch interval | Latch interval (mm)

For items surrounded by ☐, touch inside the frame and select the contents

For items surrounded by ☐, touch inside the frame and enter with the numeric key

8

## 2-3-1. Example of settings (Rotary encoder)

- When getting the data for one rotation in a single direction at 1° intervals with zero offset from the latch operation start position using a rotary encoder with 360 pulses per rotation (Signal A multiple = 1). (Rotating direction is arbitrary.)

| Item | Setting |
|---|---|
| Latch mode | Encoder or Encoder (High-speed) |
| Encoder type | Rotary |
| Resolution [P/R] | 360 |
| Direction | Arbitrary |
| Multiplication | 1 |
| Reference point | × |
| Offset count | 0 |
| Offset angle [deg] | 0 |
| Latch direction | + or - |
| Number of latch | 360 |
| Count of latch interval | 1 |
| Latch interval [deg] | 1 |

- When starting latch operation at the position 1.8° from the reference point and getting the data for two rotations in a single direction at 0.36° intervals using a rotary encoder with 2000 pulses per rotation (Signal A multiple = 1).

| Item | Setting |
|---|---|
| Latch mode | Encoder or Encoder (High-speed) |
| Encoder type | Rotary |
| Resolution [P/R] | 2000 |
| Direction | + |
| Multiplication | 1 |
| Reference point | ✓ |
| Offset count | +10 |
| Offset angle [deg] | +1.8 |
| Latch direction | + |
| Number of latch | 2000 |
| Count of latch interval | 2 |
| Latch interval [deg] | 0.36 |

## 2-3-2. Example of settings (Linear encoder)

- When getting 20 points of data at 30 mm intervals in only one direction starting from the current position (zero) using a linear encoder with a resolution of 10 µm (multiple = 4) and no reference point. (Direction is arbitrary.)

| Item | Setting |
|---|---|
| Latch mode | Encoder or Encoder (High-speed) |
| Encoder type | Linear |
| Resolution [µm] | 10 |
| Direction | + |
| Multiplication | 4 |
| Reference point | × |
| Offset count | 0 |
| Offset length [mm] | 0 |
| Latch direction | + |
| Number of latch | 20 |
| Count of latch interval | 3000 |
| Latch interval [mm] | 30 |

- When getting 30 points of data at 30 mm intervals in only one direction starting from the reference point position using a linear encoder with a resolution of 0.5 µm (multiple = 4). (Direction is arbitrary.)

| Item | Setting |
|---|---|
| Latch mode | Encoder or Encoder (High-speed) |
| Encoder type | Linear |
| Resolution [µm] | 0.5 |
| Direction | + |
| Multiplication | 4 |
| Reference point | ✓ |
| Offset count | 0 |
| Offset length [mm] | 0 |
| Latch direction | + |
| Number of latch | 30 |
| Count of latch interval | 60000 |
| Latch interval [mm] | 30 |

## 2-4. Monitor function

After each item in the Latch module settings screen has been set, you can check whether the encoder connected to the MG80-LM (latch module) is operating in accordance with the settings. Use the monitor function to check latch operation prior to measurement when making or changing the latch module settings.



Latch module settings
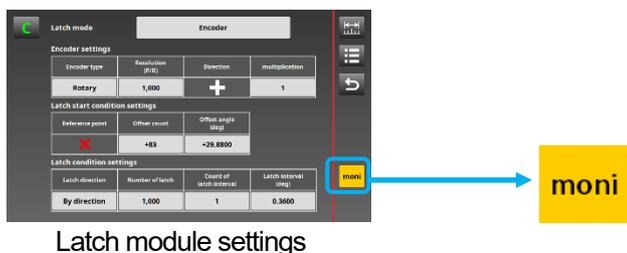
Touch the monitor button moni to display the following monitor screen. (When "Rotary" is selected)
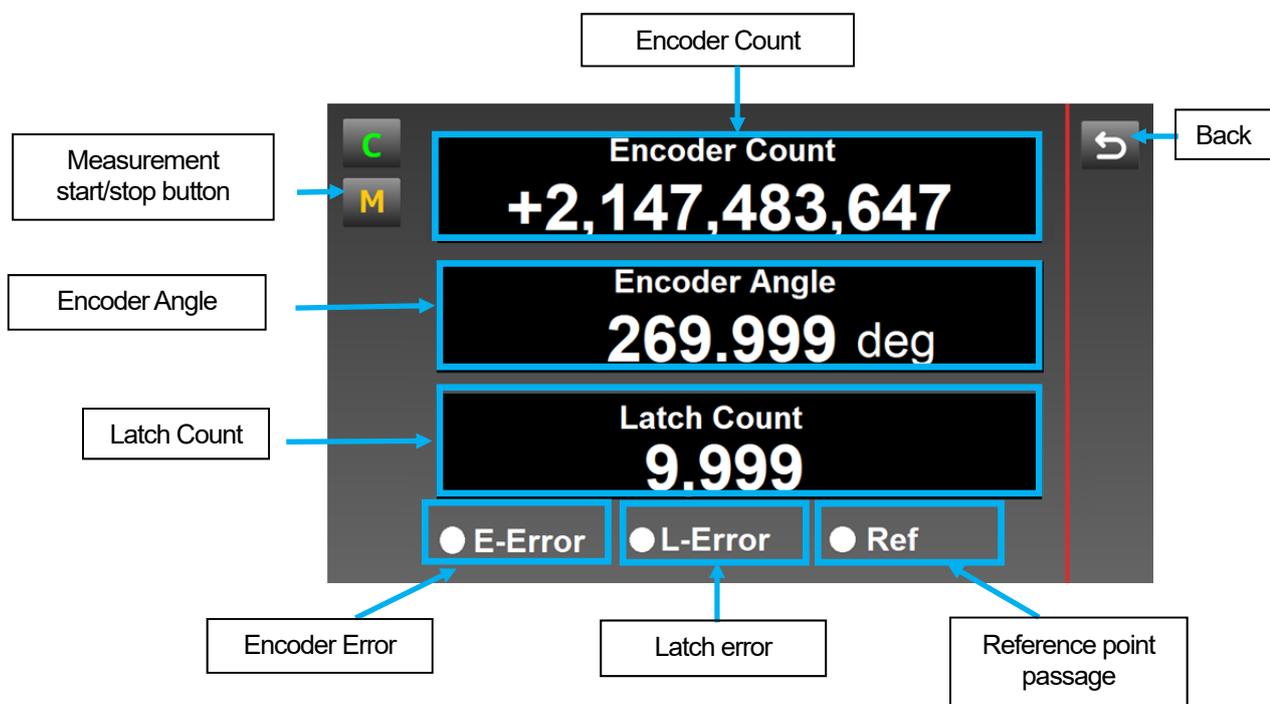


- Measurement start/stop button
  The measurement start/stop button is used when performing latch operation.
  The button text color changes according to the status as follows.

  M : Latch operation stopped (Standby status for operation)

  M : Latch operation in progress, standby for encoder signal input

  M : Latch operation in progress

  M : When a latch error or encoder error occurs

11

• **Check method**

  Press the measurement start/stop button to enter the measuring status, and rotate (move) the encoder as if performing actual latch operation.
  Latch operation stops automatically when the latch count reaches the setting value.

• **Check procedure**

  When the display is switched from the Latch module settings screen to the Monitor screen, all the values on the Monitor screen are zero or the values at the time of the previous operation.

  When the measurement start/stop button  is pressed, the button changes to  (Standby for encoder signal input).
  ↓
  When the encoder is rotated (moved), the button changes to  (Latch operation in progress).
  ↓
  When the latch count reaches the latch count set in the Latch module settings screen, the button returns to  (Stopped).

  Check that each count value at this time actually matches the set latch count for the encoder operation.

  * When the measurement start/stop button changes to  during this operation, this means that a latch error or encoder error has occurred.

    Latch error: The latch timing was less than 400 μs in Latch mode or 100 μs in Latch mode (High-speed).
    Reduce the encoder rotation (movement) speed or widen the latch interval.

    Encoder error: An abnormality (disconnection, response speed exceeded) has occurred in the encoder connected to the MG80-LM.
    Check the encoder status.

  * About the reference point
  MG80-LM reference point detection is unidirectional. When using the reference point, be sure to pass the reference point from the same direction each time.
  Deviation of ±1 count from the setting value may occur depending on the reference point specification.
  Always use the monitor function and adjust with the offset value when deviation occurs in the reference point position.

## 2-5. Measurement method

Use the monitor function and check whether the encoder connected to the MG80-LM (latch module) is operating in accordance with the settings.

Operation is performed on the measuring screen.
When Latch mode in the Latch module settings screen is set to "Encoder" or "Encoder (High-speed)," the measuring screen is as follows.

Measurement start/stop button
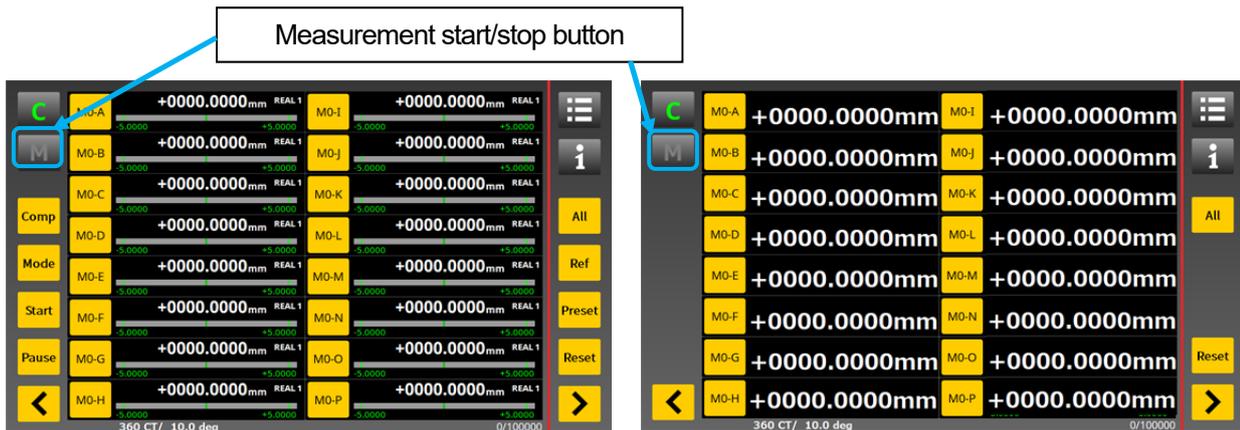
When set to "Encoder"                                        When set to "Encoder (High-speed)"

\* When set to "Encoder", the functions displayed in the measuring screen are available while latch operation is stopped.
When set to "Encoder (High-speed)", comparator functions and operations other than reset are not available.

• Measurement start/stop button
Measurement is performed using the measurement start/stop button.
The button text color changes according to the status as follows.

**M** : Latch operation stopped (Standby status for operation)
The button text color changes to gray after power-on, after settings are changed, and after latch operation ends (the set latch count is reached).

**M** : Latch operation in progress, standby for encoder signal input
When the measurement start/stop button is pressed while latch operation is stopped, operation enters the standby status for encoder operation and the button text color changes to orange.

**M** : Latch operation in progress
When the encoder signal is detected and latch operation starts, the button text color changes to green.

**M** : When a latch error or encoder error occurs
When a latch timing or encoder abnormality is detected, the button text color changes to red.
Press the measurement start/stop button to cancel the error.

**• Operation procedure**

Check that the measurement start/stop button text color is ☐ .

In this status, each function (the functions displayed in the measuring screen) operates, but the measurement values of the measurement units in each frame are not updated.

The measurement values are updated when the encoder signal is input during latch operation.

Example: When all the frames are selected and reset operation is performed, the measurement values are reset when the encoder signal is input.

When the measurement start/stop button ☐ is pressed, the button changes to **M** Standby for encoder signal input).

↓

When the encoder is rotated (moved), the button changes to **M** (Latch operation in progress).

↓

When the latch count reaches the latch count set in the Latch module settings screen, the button returns to ☐ (Stopped).

\* Function operations cannot be performed while standing by for encoder signal input or during latch operation.



The current position of the encoder and the number of data acquired are displayed at the bottom of the measuring screen.



| Latch pulse count/angle | Saved data counter |

\* The saved data counter displays the number of data saved in the display unit. The maximum number of saved data is 300,000 data.

Latch operation data is saved, and data is accumulated for each operation.

\* When the number of data exceeds 300,000 data, the data is cleared in order from the oldest data.

\* To use the saved data, first export it to an external memory.

\* The data saved in the display unit is cleared when power supply to the display unit is cut off.

## 2-6. I/O operation (when Latch mode is "Encoder")

• Input
All display unit I/O and LZ80-K (I/O module) input operations can be performed while latch operation is stopped (standby status for operation).

Input operations cannot be performed during latch operation.
(Except for display unit I/O latch start, and I/O module frame address and data valid)
* The input operations indicate the input status in Measurement mode, Comparator set number and Pause indicator in the view frame of the measuring screen, but the measurement data and the comparator bar display are applied when the encoder signal is detected.

• Output
The display unit I/O and the LZ80-K (I/O module) output the current status while latch operation is stopped (standby status for operation).
The display unit I/O and the LZ80-K (I/O module) output all statuses while latch operation is in progress.
The I/O module outputs the status of the frame specified by the frame address.
(Input operations performed at this time are not applied.)

• Added latch operation functions
The following I/O functions have been added to the display unit I/O.

Input

| Selection symbol | Description | Function | Terminal logic |
|---|---|---|---|
| D-Trig LM-Start | Data trigger/ Latch start | Saves the data of all frames in the display unit memory/Latch measurement start/stop. (When using the MG80-LM) | ON |

Output

| Selection symbol | Description | Function | Terminal logic |
|---|---|---|---|
| LM-Moni | Latch status | Latch operation in progress | ON during operation |
| LM-Alarm | Latch alarm | MG80-LM latch module alarm output | ON when an alarm occurs |

* I/O operation (when Latch mode is "Encoder (High-speed)")
When Latch mode is set to "Encoder (High-speed)", the LZ80-K (I/O module) cannot be used.
Only the display unit I/O reset and data trigger/latch start input operations can be performed while latch operation is stopped (standby status for operation).
The valid display unit I/O outputs are only the system alarm, status monitor output, latch status, and latch alarm.

## 2-7. Data save and data format

To use the saved data, first export it to an external memory.
Refer to page 30 of the LT80-NE Operating Manual (V1.02.00) for the export method.
* The data format contents change when using the MG80-LM.

・Data format (when using the MG80-LM)
The data is separated by the delimiter set using the Data menu. The position of the encoder that acquired the data and the measurement data and statuses of all view frames are output on a single line.

①, ②, ③, ④, ⑤, ⑥, ⑦, ⑧, ⑨, ⑥, ⑦, ⑧, ⑨・・・・・・・・

Header          Frame A          Frame B
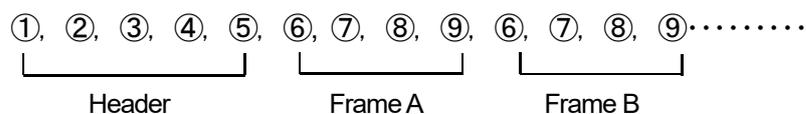
①: Data count          1 to 300000
②: Time stamp          The format is set using the Data menu.
③: Module ID           Main module ID
④: Encoder position    Encoder angle or length when the data is acquired
⑤: Latch module
   Status (1byte)       bit7   CRC error = 1
                        bit6   Reserved = 0
                        bit5   Reserved = 0
                        bit4   Reserved = 0
                        bit3   Reference point passed = 1, reference point not passed = 0
                        bit2   Reserved = 0
                        bit1   Latch module error = 1
                        bit0   Encoder error = 1
⑥: Measurement data    -9999.9999 to 9999.9999
⑦: Measuring mode      REAL = 0, MAX = 1, MIN = 2, P-P = 33
⑧: Comparator          < C1 = 0, C1 < C2 = 1, C2 < C3 = 2, C3 < C4 = 3, C4 < = 4
⑨: Counter module
   Status (1byte)       bit7   CRC error = 1
                        bit6   Pause ON=1     Pause OFF=0
                        bit5   Reserved = 0
                        bit4   Reserved = 0
                        bit3   Reference point passed = 1, reference point not passed = 0
                        bit2   Reserved = 0
                        bit1   Counter error = 1
                        bit0   Measuring unit error = 1

## 2-8. Operation sequence and I/O operations

| Measuring screen | Display unit I/O | I/O module |

Latch operation stopped (Standby status for operation)



Input: All operations are available.
The measurement data and comparator bar display hold the current status, and input operations are not applied to the frames.

Output: Outputs the current status.

Standby for encoder signal input



Input: LM-Start
Other operations are not available.

Output: Outputs the current status.

Input: Operations not available.

Output: Outputs the current status.

Latch operation in progress



Input: LM-Start
Other operations are not available.
Input operations while operation is stopped are applied.

Output: Outputs the current status.

Input: Operations not available
Input operations while operation is stopped are applied.
Frame addresses for output can be selected.

Output: Outputs the status of the selected frames.

Latch operation stopped (Data acquisition ended)



Save the acquired data in an external memory. (Continued data acquisition is also possible.)

日本からの輸出時における注意

本製品（および技術）は輸出令別表第1の16の項（外為令別表16の項）に該当します。キャッチオール規制による経済産業省の許可要否につきましては、輸出者様にてご確認ください。

**For foreign customers**

**Note:** This product (or technology) may be restricted by the government in your country. Please make sure that end-use, end user and country of destination of this product do not violate your local government regulation.

# Magnescale Co., Ltd.

45 Suzukawa, Isehara-shi, Kanagawa 259-1146, Japan