selec

# MRJ385

Operating Instructions


96x96

## SPECIFICATIONS

**DISPLAY**

Liquid crystal display with backlight
4 lines, 4 digits per line to show electrical Parameters
5th line, 8 digits to show energy
Bar graph for current indication as percentage of CT rating

**LCD INDICATIONS**

- **-** Integration of energy
- **PRG** - Unit is in configuration menu
- - Communication in progress
- **MAX DMD** - Maximum & Minimum Demand of Power

**WIRING INPUT**

3 Ø - 4 wire

**RATED INPUT VOLTAGE**

100 to 240V AC (L-N) ; 173 to 415V AC (L-L)

**FREQUENCY RANGE**

45-65 Hz

**CT PRIMARY**

5A to 10,000A (Programmable for any Value)

**CT SECONDARY**

330mV

**PT PRIMARY**

100V to 500kV (Programmable for any value)

**PT SECONDARY**

100 to 500V AC (L-L)(Programmable for any value)

**Display update time**

1 sec for all parameters

**Display Scrolling**

Automatic / Manual

**AUXILIARY**

Self supplied

**TEMPERATURE**

Operating : 0 to 50°C
Storage : -20 to 75°C

**HUMIDITY**

85% non-condensing

**MOUNTING**

Panel mounting

**WEIGHT**

230gms

**OUTPUT**

**Pulse Output :** Voltage range : External 24V DC max.
Current capacity : 100 mA max
**Pulse Width :** Selectable between 50ms to 250ms

## SERIAL COMMUNICATION

| | |
|---|---|
| **Interface standard & protocol** | RS485 & MODBUS RTU |
| **Communication address** | 1 to 255 |
| **Transmission mode** | Half duplex |
| **Data types** | Float and Integer |
| **Transmission distance** | 500 Metre maximum |
| **Transmission speed** | 300, 600,1200, 2400, 4800, 9600,19200 (in bps) |
| **Parity** | None, Odd, Even |
| **Stop bits** | 1 or 2 |
| **Response time** | 100 ms (max and independent of baud rate) |

## PULSE VALUE

| CT Rating | kWh |
|---|---|
| 160A | 0.1K |
| 250A | 0.1K |
| 400A | 0.1K |
| 800A | 1K |

**NOTE :** 1) For Voltage, Current, Power, resolution is automatically adjusted.
2) For power factor, resolution is 0.001
3) INT blinks after every 5 seconds, if load is connected on at least any one of 3 phases.

## ACCURACY

| Measurement | Accuracy |
|---|---|
| Voltage $V_{L-N}$ | ±0.5% of Full scale |
| Voltage $V_{L-L}$ | ±0.5% of Full scale |
| Current | ±0.5% of Full scale |
| Frequency | ±0.1% For L-N Voltage >20V , For L-L Voltage >35V |
| Active Power | 1% |
| Apparent power | 1% |
| Reactive Power | 1% |
| Power factor | ±0.01 |
| Active energy | 1% |
| Reactive energy | 1% |
| Apparent energy | 1% |
| MAX / MIN Active Power | 1% |
| MAX / MIN Reactive Power | 1% |
| MAX Apparent Power | 1% |

## SAFETY PRECAUTIONS

All safety related codifications, symbols and instructions that appear in this operating manual or on the equipment must be strictly followed to ensure the safety of the operating personnel as well as the instrument.

If the equipment is not used in a manner specified by the manufacturer it might impair the protection provided by the equipment.

⚠ **CAUTION**

Read complete instructions prior to installation and operation of the unit.

⚠ **CAUTION :** Risk of electric shock.

## WIRING GUIDELINES

⚠ **WARNING:**

1. To prevent the risk of electric shock, power supply to the equipment must be kept OFF whilst installing the wiring .
2. Wiring shall be done strictly according to the terminal layout. Confirm that all connections are correct.
3. Cable used for connection to power source, must have a cross section of 1.5mm$^2$. These wires shall have current carrying capacity of 6A.
4. Before attempting work on device, ensure absence of voltages using appropriate voltage detection device.

## MAINTENANCE

1. The equipment should be cleaned regularly to avoid blockage of ventilating parts.
2. Clean the equipment with a clean soft cloth.
   Do not use Isopropyl alcohol or any other cleaning agent.

## INSTALLATION GUIDELINES

⚠ **CAUTION:**

1. This equipment, being of a built-in-type, normally becomes a part of a main control panel and in such case the terminals do not remain accessible to the end user after installation and internal wiring.
2. Conductors must not come in contact with the internal circuitry of the equipment or it may lead to a safety hazard that may in turn endanger life or cause electrical shock to the operator.
3. Protection & disconnection means must be installed between power source and supply terminals to facilitate power 'ON' or 'OFF' function & must be installed in a convenient position normally accessible to the operator.

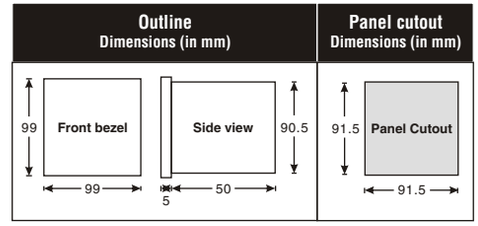
⚠ **CAUTION :**

The equipment shall not be installed in environmental conditions other than those mentioned in this manual.

## MECHANICAL INSTALLATION

For installing the meter

1. Prepare the panel cutout with dimensions as shown below :




2. Push the meter into the panel cutout. Secure the meter in its place by fitting the clamp from the rear side. Fit clamps on both sides in diagonally opposite location for optimum fitting.
3. For proper sealing, tighten the screws evenly with required torque.
4. Recommended conductor cross section = 1.5mm$^2$
   Screw clamp tightening torque = 0.1N-m

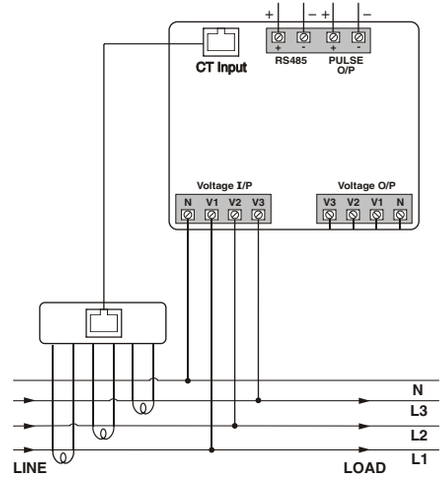
⚠ **CAUTION:**

The equipment in its installed state must not come in close proximity to any heating sources, caustic vapors, oil, steam, or other unwanted process by-products.

**EMC Guidelines:**

1. Use input power cables with shortest connections.
2. Layout of connecting cables shall be away from any internal EMI source.

## TERMINAL CONNECTIONS



# MODBUS REGISTER ADDRESSES LIST

## MODBUS register addresses list

**Readable Parameters For MRJ385**

| Address | Hex Address | Parameter | | Length (Register) | Data Structure |
|---|---|---|---|---|---|
| 30000 | 0x00 | Voltage V1N | | 2 | Float |
| 30002 | 0x02 | Voltage V2N | | 2 | Float |
| 30004 | 0x04 | Voltage V3N | | 2 | Float |
| 30006 | 0x06 | Average Voltage LN | | 2 | Float |
| 30008 | 0x08 | Voltage V12 | | 2 | Float |
| 30010 | 0x0A | Voltage V23 | | 2 | Float |
| 30012 | 0x0C | Voltage V31 | | 2 | Float |
| 30014 | 0x0E | Average Voltage LL | | 2 | Float |
| 30016 | 0x10 | Current I1 | | 2 | Float |
| 30018 | 0x12 | Current I2 | | 2 | Float |
| 30020 | 0x14 | Current I3 | | 2 | Float |
| 30022 | 0x16 | Average Current | | 2 | Float |
| 30024 | 0x18 | kW1 | | 2 | Float |
| 30026 | 0x1A | kW2 | | 2 | Float |
| 30028 | 0x1C | kW3 | | 2 | Float |
| 30030 | 0x1E | kVA1 | | 2 | Float |
| 30032 | 0x20 | kVA2 | | 2 | Float |
| 30034 | 0x22 | kVA3 | | 2 | Float |
| 30036 | 0x24 | kVAr1 | | 2 | Float |
| 30038 | 0x26 | kVAr2 | | 2 | Float |
| 30040 | 0x28 | kVAr3 | | 2 | Float |
| 30042 | 0x2A | Total KW | | 2 | Float |
| 30044 | 0x2C | Total KVA | | 2 | Float |
| 30046 | 0x2E | Total KVAr | | 2 | Float |
| 30048 | 0x30 | PF1 | | 2 | Float |
| 30050 | 0x32 | PF2 | | 2 | Float |
| 30052 | 0x34 | PF3 | | 2 | Float |
| 30054 | 0x36 | Average PF | | 2 | Float |
| 30056 | 0x38 | Frequency | | 2 | Float |
| 30058 | 0x3A | kWh | | 2 | Float |
| 30060 | 0x3C | kVAh | | 2 | Float |
| 30062 | 0x3E | kVArh | | 2 | Float |
| 30064 | 0x40 | kW Max Active Power | | 2 | Float |
| 30066 | 0x42 | kW Min Active Power | | 2 | Float |
| 30068 | 0x44 | kVAr Max Reactive Power | | 2 | Float |
| 30070 | 0x46 | kVAr Min Reactive Power | | 2 | Float |
| 30072 | 0x48 | kVA Max Apparent Power | | 2 | Float |
| 30074 | 0x4A | MAX I1 Demand | | 2 | Float |
| 30076 | 0x4C | MAX I2 Demand | | 2 | Float |
| 30078 | 0x4E | MAX I3 Demand | | 2 | Float |
| 30080 | 0x50 | MAX Avg Demand | | 2 | Float |
| 30082 | 0x52 | Run hour | | 2 | Float |
| 30084 | 0x54 | kWh1 (Imp) | | 2 | Float |
| 30086 | 0x56 | kWh2 (Imp) | | 2 | Float |
| 30088 | 0x58 | kWh3 (Imp) | | 2 | Float |
| 30090 | 0x5A | kWh1 (Exp) | | 2 | Float |
| 30092 | 0x5C | kWh2 (Exp) | | 2 | Float |
| 30094 | 0x5E | kWh3 (Exp) | | 2 | Float |
| 30096 | 0x60 | Total kWh (Imp) | | 2 | Float |
| 30098 | 0x62 | Total kWh (Exp) | | 2 | Float |
| 30100 | 0x64 | kVArh1 (Imp) | | 2 | Float |
| 30102 | 0x66 | kVArh2 (Imp) | | 2 | Float |
| 30104 | 0x68 | kVArh3 (Imp) | | 2 | Float |
| 30106 | 0x6A | kVArh1 (Exp) | | 2 | Float |
| 30108 | 0x6C | kVArh2 (Exp) | | 2 | Float |
| 30110 | 0x6E | kVArh3 (Exp) | | 2 | Float |
| 30112 | 0x70 | Total kVArh (Imp) | | 2 | Float |
| 30114 | 0x72 | Total kVArh (Exp) | | 2 | Float |
| 30116 | 0x74 | kVAh1 | | 2 | Float |
| 30118 | 0x76 | kVAh2 | | 2 | Float |
| 30120 | 0x78 | kVAh3 | | 2 | Float |

**Readable / writable parameters :**

| Address | Hex Address | Parameter | Range | | Length (Register) | Data Structure |
|---|---|---|---|---|---|---|
| | | | **Min value** | **Max value** | | |
| 40000 | 0x00 | Password | 0 | 9998 | 1 | Integer |

## MODBUS register addresses list *continued*

**Readable / writable parameters from MRJ385 :**

| Address | Hex Address | Parameter | Range | | Length (Register) | Data Structure |
|---|---|---|---|---|---|---|
| | | | **Value** | **Meaning** | | |
| 40001 | 0x01 | N/W Selection **(Readable Only)** | 0 | 3P-4W | 1 | Integer |
| | | | 1 | 3P-3W | 1 | Integer |
| | | | **Value** | **Meaning** | | |
| 40002 | 0x02 | CT Secondary **(Readable Only)** | 1 | | | |
| | | | 5 | | | |
| | | | **Write Value** | **Meaning** | | |
| 40003 | 0x03 | CT primary (CT Secondary = 5) | 5 | 10000 | 1 | Integer |
| | | CT primary (CT Secondary = 1) | 1 | 10000 | | |
| 40004 | 0x04 | PT Secondary | 100 | 500 | 1 | Integer |
| 40005 | 0x05 | PT primary | 100 | 500kV | 2 | Integer |
| | | | **Value** | **Meaning** | | |
| 40007 | 0x07 | Slave id | 1 | 255 | 1 | Integer |
| 40008 | 0x08 | Baud rate | 0x0000 | 300 | 1 | Integer |
| | | | 0x0001 | 600 | | |
| | | | 0x0002 | 1200 | | |
| | | | 0x0003 | 2400 | | |
| | | | 0x0004 | 4800 | | |
| | | | 0x0005 | 9600 | | |
| | | | 0x0006 | 19200 | | |
| 40009 | 0x09 | Parity | 0x0000 | None | 1 | Integer |
| | | | 0x0001 | Odd | | |
| | | | 0x0002 | Even | | |
| 40010 | 0x0A | Stop bit | 0x0000 | 1 | 1 | Integer |
| | | | 0x0001 | 2 | | |
| | | | **Min value** | **Max value** | | |
| 40011 | 0x0B | Backlight OFF | 0 | 7200 | 1 | Integer |
| 40012 | 0x0C | Factory Default | 1 | Set to factory setting range | 1 | Integer |
| 40016 | 0x10 | Auto Mode Pages | Min Value :1 | Max Value : 8 | | |
| | | | **Page No** | **Meaning** | | |
| 40017 | 0x11 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40018 | 0x12 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40019 | 0x13 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40020 | 0x14 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40021 | 0x15 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40022 | 0x16 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40023 | 0x17 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40024 | 0x18 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40025 | 0x19 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40026 | 0x1A | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40027 | 0x1B | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40028 | 0x1C | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40029 | 0x1D | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40030 | 0x1E | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40031 | 0x1F | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40032 | 0x20 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40033 | 0x21 | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| | | | **Value** | **Meaning** | | |
| 40034 | 0x22 | Demand Interval Method | 0X0000 | Sliding | 1 | Integer |
| | | | 0X0001 | Fixed | | |
| 40035 | 0x23 | Demand Interval Duration | MIN Value : 1 | MAX Value : 30 | 1 | Integer |
| 40036 | 0x24 | Demand Interval Length | MIN Value : 1 | MAX Value : 30 | 1 | Integer |
| 40042 | 0x2A | Page Address Sequence | 1-18 | 1-First Page; 18-Last Page | 1 | Integer |
| 40043 | 0x2B | Reset Max | 1 | Reset all Max power | 1 | Integer |
| 40044 | 0x2C | Reset Energy | 1 | Reset all energy to factory setting range | 1 | Integer |
| 40045 | 0x2D | Reset Run Hour | 1 | Reset Run hour | 1 | Integer |

## FRONT PANEL DESCRIPTION


## ONLINE PAGE DESCRIPTION

There are 6 dedicated keys labelled as V, I, VAF, PF, P, E. Use these 6 keys to read meter parameters. Simply press these keys to read the parameters.

| KEY PRESS | ONLINE PAGE DESCRIPTION |
|---|---|
| **Press "V"** | **The first screen**: Displays Line to Neutral Voltage of three phases & average Line to Neutral Voltage.<br>**The second screen**: Displays Line to Line Voltage of three phases & average line to line Voltage. |
| **Press "I"** | **The first screen** : Displays phase Current of three phases & average phase Current.<br>**The second screen** : Displays the maximum current demand. |
| **Press "VAF"** | **The first screen**: Displays Voltage, Current, Power factor of first phase & Frequency.<br>**The second Screen**: Displays Voltage, Current, Power factor of second phase & Frequency.<br>**The third Screen**: Displays Voltage, Current, Power factor of third phase & frequency.<br>**The fourth Screen**: Displays Average, Value of Voltage, Current, Power factor of three phases & Frequency. |
| **Press "PF"** | **The first screen:** Displays Power factor of three phases & average Power factor. |
| **Press "P"** | **The first screen :** Displays Active power of three phases & total Active Power.<br>**The second screen:** Displays Reactive Power of three phases & total Reactive Power.<br>**The third screen :** Displays Apparent Power of three phases & total Apparent Power.<br>**The fourth screen :** Displays Active, Reactive , Apparent power & Power factor of first phase.<br>**The fifth screen :** Displays Active, Reactive, Apparent power & Power factor of second phase.<br>**The sixth screen :** Displays Active, Reactive, Apparent power & Power factor of third phase.<br>**The seventh screen :** Displays total Active, Reactive , Apparent power & average Power factor of three phases.<br>**The eighth screen :** Displays maximum Active power demand, Reactive power demand & Apparent power demand.<br>**The ninth screen :** Displays minimum Active power demand & Reactive power demand. |
| **Press "E"** | **The first screen :** Displays phasewise Active energy of three phases.<br>**The second screen :** Displays phasewise Reactive energy of three phases.<br>**The third screen :** Displays phasewise Apparent energy of three phases.<br>**The fourth screen :** Displays total Run hour |

## AUTOMATIC / MANUAL MODE DESCRIPTION

Press E (↵) button for 3 seconds to toggle between Automatic & Manual mode.
**Note:** By default unit operates in automatic mode.
In automatic mode online pages scroll automatically at the rate of 5 seconds per page.
In automatic mode when any key is pressed, unit temporarily switches to manual mode and the appropriate page is displayed, also if no key is pressed for 5 sec, unit resumes automatic mode.

## CONFIGURATION

There are 6 dedicated keys with symbols marked as ◀, ▶, ▼, ▲, ←, ↵ use these 6 keys to enter into configuration menu / change setting.

**Note :** The settings should be done by a professional, after going through this users manual and after having understood the application situation.
For the configuration setting mode :

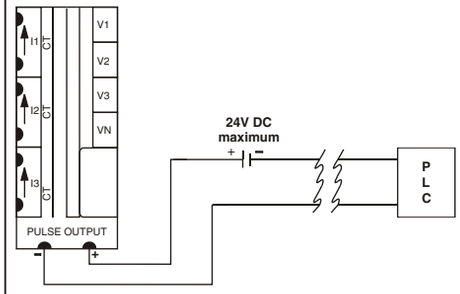
- Use ▲ + ▼ keys for 3 sec to enter or exit from the configuration menu.
- Use ◀ or ▶ keys to move curser left or right by one digit each time.
- Use ▲ or ▼ keys for increasing or decreasing parameters value.
- Use ← key to go back to previous page.
- Use ↵ key to save the setting and move on to next page.

| Config page. | Function | Range or Selection | Factory Setting |
|---|---|---|---|
| | Password | 0000 to 9998 | 1000 |
| 1 | Change Password | No / Yes | No |
| 1.1 | New Password | 0000 to 9998 | 1000 |
| 2 | Network Selection | Preset | 3P4W |
| 3 | CT Secondary | Preset | 5 |
| 4 | CT Primary | 5A to 10,000A (10.0kA) | 160 |
| 5 | PT Secondary | 100V to 500V | 350 |
| 6 | PT primary | 100V to 500kV | 350 |
| 7 | Slave Id | 1 to 255 | 1 |
| 8 | Baud Rate | 300, 600,1200, 2400, 4800, 9600 & 19200 | 9600 |
| 9 | Parity | None, Even, Odd | None |
| 10 | Stop Bit | 1 or 2 | 1 |
| 11 | Back Light | 0 to 7200 sec. | 0000 |
| 12 | Demand interval method | Sliding / Fixed | Sliding |
| 13 | Demand interval duration | 1 to 30 | 15 |
| 14 | Demand interval length | 1 to 30 min | 1 |
| 15 | Max Page Auto | 1 to 18 | 18 |
| 16 | Change Page Sequence | No / Yes | No |
| 16.01 | Page sequence 1 | _____ | 1 |
| 16.02 | Page sequence 2 | _____ | 2 |
| 16.03 | Page sequence 3 | _____ | 3 |
| 16.04 | Page sequence 4 | _____ | 4 |
| 16.05 | Page sequence 5 | _____ | 5 |
| 16.06 | Page sequence 6 | _____ | 6 |
| 16.07 | Page sequence 7 | _____ | 7 |
| 16.08 | Page sequence 8 | _____ | 8 |
| 16.09 | Page sequence 9 | _____ | 9 |
| 16.10 | Page sequence 10 | _____ | 10 |
| 16.11 | Page sequence 11 | _____ | 11 |
| 16.12 | Page sequence 12 | _____ | 12 |
| 16.13 | Page sequence 13 | _____ | 13 |
| 16.14 | Page sequence 14 | _____ | 14 |
| 16.15 | Page sequence 15 | _____ | 15 |
| 16.16 | Page sequence 16 | _____ | 16 |
| 16.17 | Page sequence 17 | _____ | 17 |
| 16.18 | Page sequence 18 | _____ | 18 |
| 17 | Pulse duration | 50, 100, 150, 200 & 250 | 200 |
| 18 | Factory Default | No / Yes | NO |
| 19 | Reset Energy & Max Demand | No / Yes | NO |
| •19.1 | Password | 0001 To 9999 | 1001 |
| 19.01 | Reset Active Energy | No / Yes | NO |
| 19.02 | Reset Reactive Energy | No / Yes | NO |
| 19.03 | Reset Apparent Energy | No / Yes | NO |
| 19.04 | Reset Max Power | No / Yes | NO |
| 19.05 | Reset Run Hour | No / Yes | NO |

● For resetting energy parameters user will be prompted for password. If correct password is entered, the user will be able to reset all energy parameters. This password will be value which will be greater than the configuration password by 1.

## APPLICATION OF PULSE OUTPUT

● **PROCESS INTEGRATION**




Pulse output from MRJ385 meter can be interfaced into a process through a PLC for on line control of energy content in the process.
If the PLC has a self excited 24V digital input, external 24V DC supply is not needed.
The kWh pulse is also used to derive average kWh information at the PLC.

## LEFT HAND CT MOUNTING PHASE CORRECTION

The meter phases L1, L2 & L3 are setup as default for the CT to be mounted as an incomer or on the RHside of the board.
Meter display shows rH when "I" is pressed for 3 seconds.
When the CT is mounted on the LH side of the board the phase sequence needs to be reversed.

1. Press "I" for seconds, then release and then press again for 3 seconds. Phase will be reversed and display will show LH
2. Wait 5 seconds for meter to resume online reading. Meter display shows LH when "I" is pressed for 3 seconds.

**Meter/CT Ratio Setup -**
the meter default CT setting is 160A. to set the meter to other CT sizes follow instructions below.

1. Press ▼ & ▲ keys together for 3 seconds to enter configuration menu.
2. To enter default password 1000 - Press ◀ then press ▲. Press ↵ 4 times to move on and to enter CT primary page 04.
3. Press ◀ or ▶ to select the digit to change and press ▲ or ▼ to raise or lower the CT value. Set to 250,400or 800 to match CT.
4. Press ↵ to save settings and move on.
5. Press ▼ & ▲ keys together for 3 seconds to exit configuration menu.

**Specifications subject to change as development is a continuous process.**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