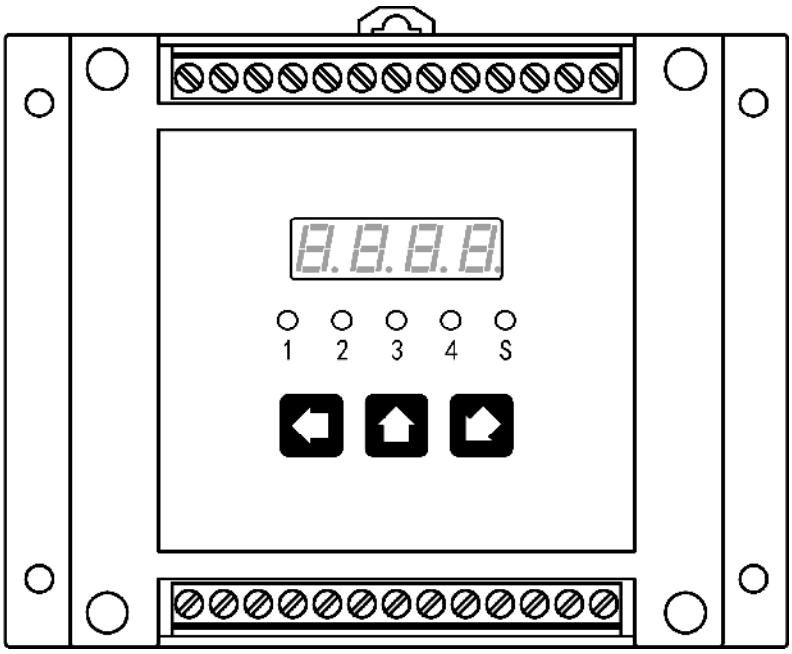
**Universal Control Unit UC-3N**

UC-3N **通用润滑系统控制站**

# User's Manual

# 用户操作指导手册




**Suzhou Leetern Industry Control Department**

**Dec. 2011**

Universal lubrication system controller UC-3N is a control station specially designed for centralized lubrication control. UC-3N has multiple lubrication control channels. It not only can operate as independent lubrication control station via operation on control panel and set parameters, but also can be controlled and managed via network to form intelligent networking lubrication control system.

UC-3N is a fully functional lubrication control station, it owns highly autonomous control ability. This makes UC-3N can ease host machine's management burden, reduce data traffic, and improve system reliability, lower system engineering cost, it still remains powerful detection and control ability. This is the essential difference between UC-3N and general Intelligent Lubrication control module.

UC-3N can be mounted with 35mm DIN rail or screws, which make it easy to compose an electrical control system with other standard electrical components.

UC-3N stores control modes and parameters in EEPROM, which made UC-3N can store data safely for long period without backup power supply.

UC-3N displays information with LED digital monitor and LED pilot lights, it is very easy to operate.

## Factory setting of UC-3N：

| | |
|---|---|
| PAUSE control mode---------- | Timer |
| PAUSE time---------- | 1 min |
| LUBE control mode---------- | Timer |
| LUBE time---------- | 1 min |
| Signal monitoring---------- | Follow monitoring, warning level |
| Level monitoring---------- | ON |
| External control---------- | OFF |
| Power off protection---------- | OFF |
| Control station number---------- | 247 |
| Communication interface---------- | RS-485，half duplex asynchronous communication |
| Communication baud rate--------- | 9600 |
| Communication parity---------- | Even |
| Communication protocol---------- | Modbus RTU |

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# Content

**Appendix 1: UC-3N modbus** communications protocol

**Appendix 2: Complete set of components of UC-3N**

# Safety Warning!

**Universal Control Unit UC-3N is designed and manufactured not only in conformity with the generally engineering standards, industrial safety and accident prevention regulations, but also in accordance with some relevant generally industrial technical acceptance standards.**

**Although this unit complies with relevant safety technical requirements, the use of the unit may still entail dangers leading to personal injury of the user or third parties or damage to property. Therefore, the unit must be used when it is in perfect technical condition. And the operation must strictly comply with operation manual. Errors that may affect safety must be rectified immediately.**

**The unit is designed for controlling and monitoring centralized lubrication systems. The user himself shall be liable for any damage caused by improper use.**

## Potential electrical dangers

**This unit must be connected to the power supply only by trained qualified personnel in accordance with the local electric technical regulations. Improper connection may lead to serious personal injury.**

**This unit is designed to use in battery-powered on-board electric system of chassis, engineering equipment and lubrication station. When it is used for any other purposes, all safety regulations should be complied with.**

**Note: The area that is circled by white heavy line on PCB is high voltage dangerous area. It is prohibited to touch directly with hand or with tools to avoid the danger of electric shock.**

## Qualified personnel

**Qualified person means person trained, assigned and instructed by the operator of the equipment concerned. They are familiar with relevant safety rules or regulations and have certain knowledge and skills of safety.**

**They are entitled to carry out the activities required in a given case and will be able to recognize and avoid possibly existing dangers.**

# 1. Installation

## 1.1 Installation condition

Control station UC-3N is **NOT** designed to work in open-air; it has to be installed in room or enclosed compartment to protect it from environmental influences.

### Environmental condition

Installation environment should be free of conducting dust and corrosive atmosphere, without severe vibrations, out of direct sunshine and no abrupt temperature change. Temperature range is -25℃ to +70℃ and humidity range is 20% to 90% (no condensate)

### Power supply condition

Control station UC-3N must be installed after Class II over-voltage electrical equipment, which supplies over-voltage protection. It is prohibited to install UC-3N directly to a bus bar or a trunk line. Power supply voltage range is DC 12-42V, power consumption < 4W. It is still necessary to supply the controller a separate power supply and avoid being power supplied together with large-scale electrical equipment, being far away strong electrical interference and remain well electrical ground situation.

### Installation condition

Standard DIN industry rail mounting (also can use screw to mount directly).

No matter which way is used to mount the control station, steady and secure must be guaranteed. Especially the screw method, in order to avoid the screw loosen to cause the control station fall, self-tapping screw is not allowed.

In order to ease heat dissipation, a minimum 25mm space is required on both above and beneath the control station when installation.

The panel of the control station should be perpendicular to ground when installation. If it is parallel to ground, the highest working temperature will lower 10 ℃ at least. And the environmental vibration level should be strictly controlled.

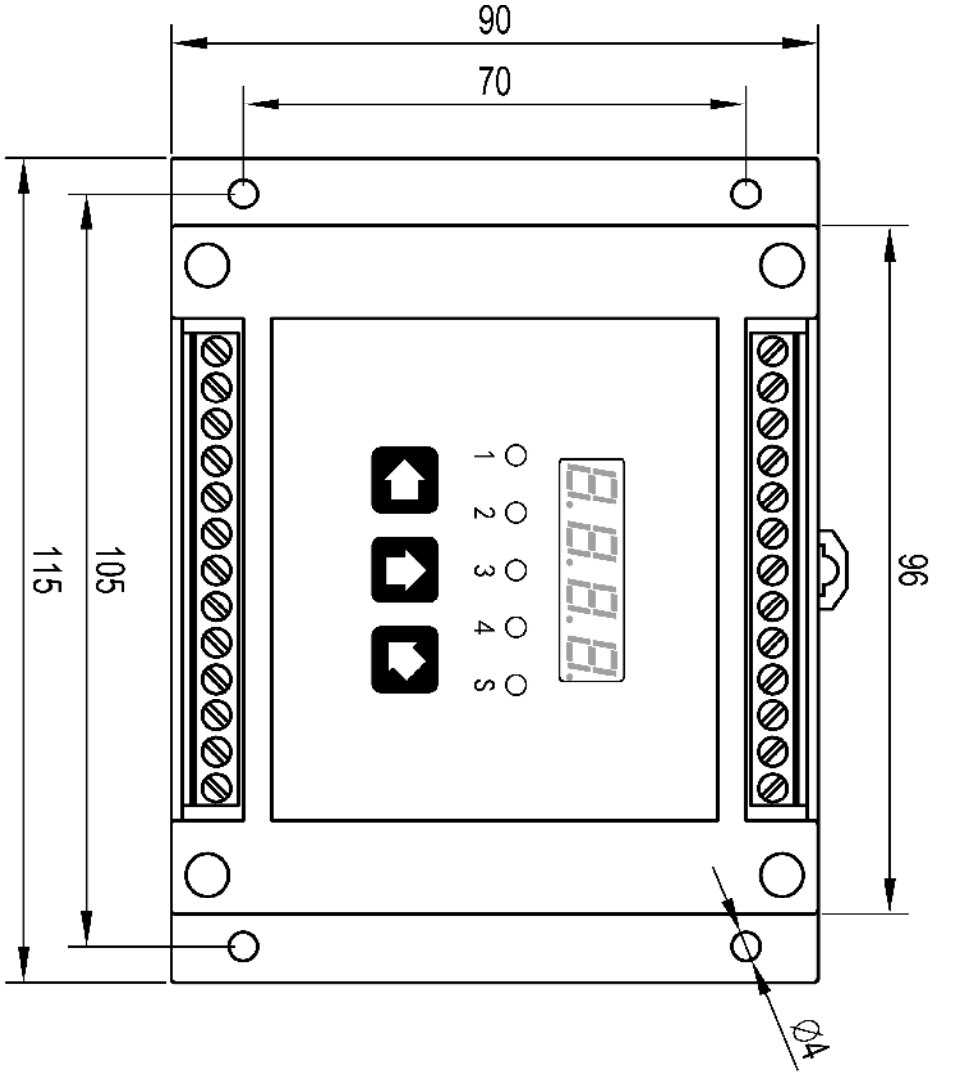
### Electrical Wiring Specifications

For signal type of wire, the cross sectional area must be 0.35mm$^2$ min to

guarantee the wire has enough mechanical strength. For power supply and control output wires, it depends on the load current situation, but 1.0mm$^2$ is required.
RS-485 network communication wire must use 0.5mm$^2$ min shield twisted pair, shield layer should be well grounded.

## 1.2 Installation dimension

*UC-3N can be supplied as set component. Please refer to appendix 2 < Complete set of components of UC-3N> for details.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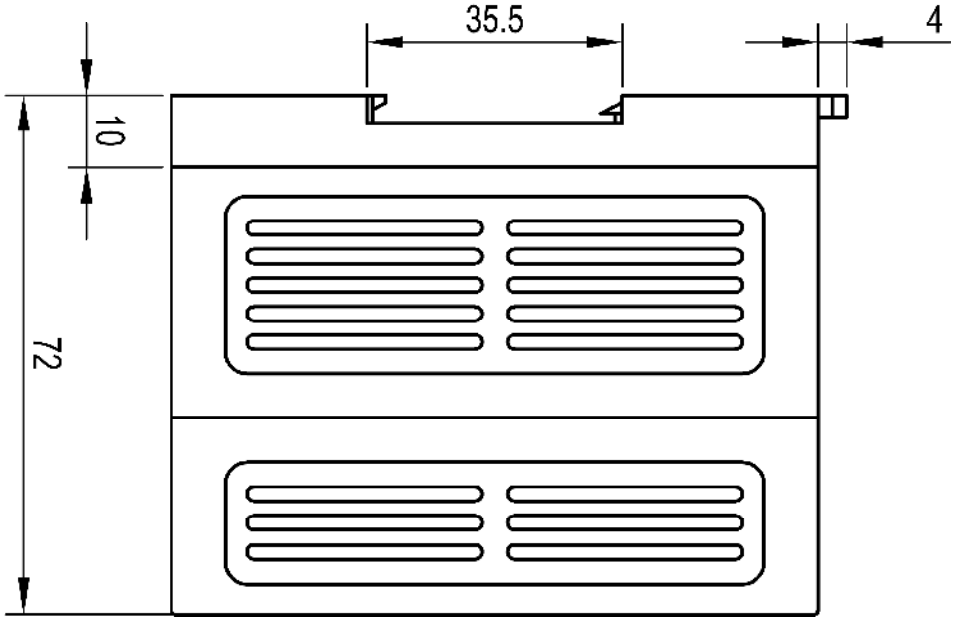
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4
10
72

## 1.3 Electrical connection

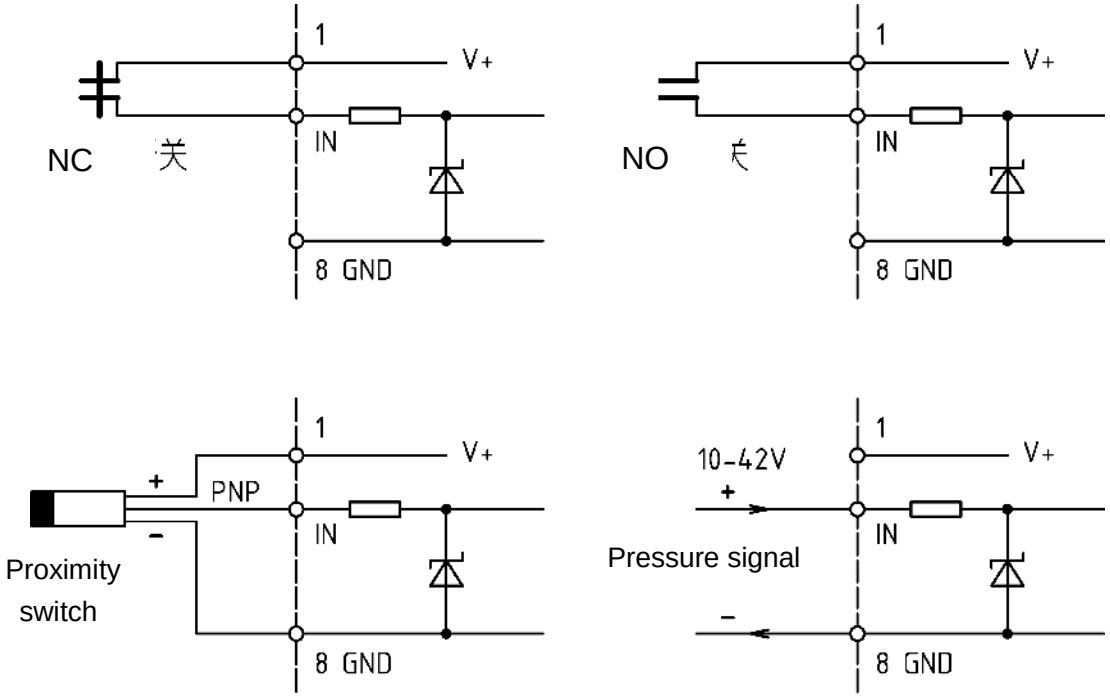
UC-3N has upper and lower two terminal blocks, used for power input, signal input, control output and network connection etc.
The terminal codes of the upper terminal block are represented by Arabic numbers. From left to right, the terminal code is 1, next is 2, 3 etc. The definition of each terminal is as follow.

| | |
|---|---|
| **1 - V+** | DC positive power output, act as external switch and sensor power supply. |
| **2 - EX** | External control switch's signal input. |
| **3 - LL** | Level switch signal input |
| **4 - D4** | Monitoring signal input of the 4th lube channel |
| **5 - D3** | Monitoring signal input of the 3rd lube channel |
| **6 - D2** | Monitoring signal input of the 2nd lube channel |
| **7 - D1** | Monitoring signal input of the 1st lube channel |
| **8 - GND** | Return circuit of internal GND |
| **9 - AGND** | Analog GND |
| **10 - A4** | The 4th analog signal input |
| **11 - A3** | The 3rd analog signal input |
| **12 - A2** | The 2nd analog signal input |
| **13 - A1** | The 1st analog signal input |

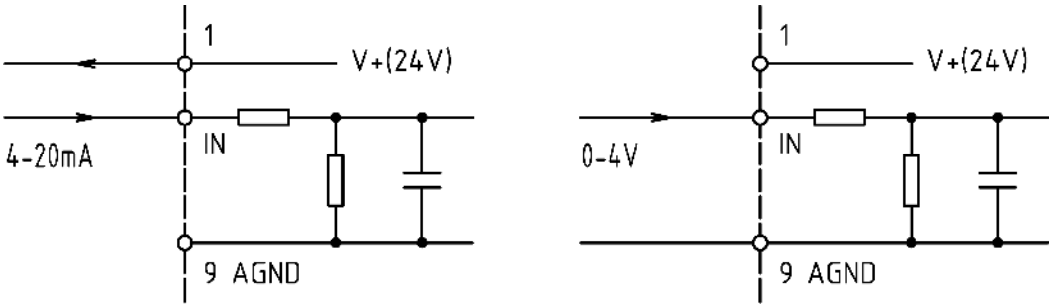
**Instruction**：

1、Terminal V+ has limited current output capability (<200mA ). It only can be used to drive external switch and sensors. It is **not allowed** to drive high current load.
2、Terminal 2-7 input digital switch signal. Input signal can be switch signal ( connect to V+ and terminal), or voltage signal (connect to terminal and GND).
3、Terminal 10-13 are used to input analog signals. Connect input terminal and AGND. It is not allowed to misconnect the return circuit to GND, this will result in very strong interference, which affects the accurate measurement of *analog* quantities. For the same reason, digital switch signals return circuit cannot be connected to AGND.

Electrical connection diagrams for typical signal inputs:




**Connection diagrams for switches and digital signal input**




**Connection diagrams for analog signal input**

**(Voltage type input is optional)**

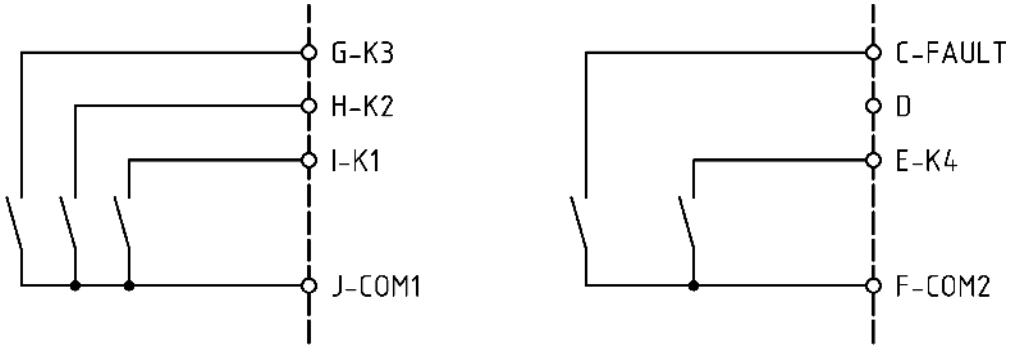
The terminal codes of the lower terminal block are represented by English letters. From left to right, the terminal code is A, next is B, C etc. The definition of each terminal is as follow.

| | |
|---|---|
| **A - GND** | GND (DC power input) |
| **B - V+** | +12V~42V (DC power input) |
| **C - K6** | Fault relay |
| **D - K5** | Vacancy |
| **E - K4** | Relay output of the 4th lube channel |
| **F - COM2** | Common terminal for 2nd group output |
| **G - K3** | Relay output of the 3rd lube channel |
| **H - K2** | Relay output of the 2nd lube channel |
| **I - K1** | Relay output of the 1st lube channel |
| **J - COM1** | Common terminal for 1st group output. |
| **K - RGND** | Ground terminal RS-485 |
| **L - B-** | Terminal RS-485 B- |
| **M - A+** | Terminal RS-485 A+ |

**Instruction：**

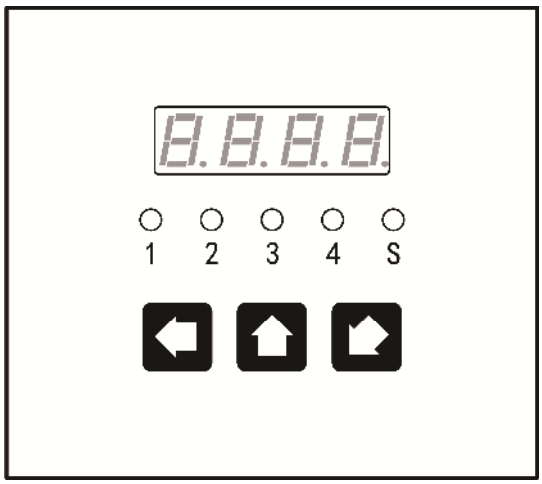
1、Terminal A and B are DC input. Please pay attention to the input voltage and polarity. There are protection circuits to protect against reverse connection, over voltage, over current and short circuit.

2、Output relays are divided into 2 groups. Each group uses a common terminal. (refer to the figures below) The 2-group relay outputs are completely electrical isolated. Both groups can withstand 250V voltage.




3、RS-485's 3 terminals are independent terminals，they have no electrical connections with any other terminals of the control station. To avoid any faults to the control station, do not misconnect them.

## 2. Display and control panel




UC-3N is designed with film panel as human machine interface.
Please use soft cloth with warm water or neutral detergent to clean the film panel. Organic solvent is prohibited.
To avoid damage to the panel, do not use sharp tools/ object to touch it.
Please do not peel off the protection film before its final installation.

### 2.1 LED monitor

LED monitor displays operating status and parameters.

### 2.2 LED signal lights

○ 1 Channel lights

The number right under the light represents the channel number (1-4). The light shows the operation status of the channel.
In operation status display mode, if the light is off, it means the channel this light represents is in PAUSE period. If the light is on, which means the relevant channel is in LUBE period; if the light is flashing, which means controller detects fault in the relevant channel.
In parameter review and programming mode, if the light is on, this means the current channel is now in parameter review or programming mode.

○ S System status indicator light

In operation status display mode, it indicates power condition and network activity condition.

When power supply condition is normal, this light is on. If control station is connected to network, if the network data is activity, this light will be flash.
In programming mode, system status indicator light on means the control station is now in system programming state.

## 2.3 Keys

 UPKEY

In operation status display mode, press key  to initiate VIEW function.
In VIEW and PROGRAMMING mode, press key  to scroll and switch the menu.
With key  , to increase the displayed value at cursor position by 1 in programming state. If the digit is already 9, then it will return to 0.

 LEFTKEY

To move left the cursor position when input parameters in programming status. If the cursor is already at the leftmost bit, then press this key, the cursor will return to the rightmost position.
In VIEW mode, if the selected channel is not in inserted lube state, and the control station is not in halt state neither, press key  can get into inserted lube state. If the selected channel is already in an inserted lube period, press key  can abort the inserted lube.

 SETUP KEY

Activate programming mode. Confirm options or parameters.

## 2.4 Fault relay SR

Fault relay SR is used to indicate the fault status of the control station. When control station works proper, the relay closes. If control station detects error in the lubrication system, the relay will open and gives alarming information.

* In programming mode, if no key operations for more than 2 minute, LED turns off automatically and quit current operation.

# 3. Operation modes

Control station UC-3N supports multiple operation modes to meet different lubrication control applications' requirements.

### 3.1 PAUSE mode

In PAUSE state, control station does not perform lubrication task. When the preset PAUSE parameter decrease progressively to 0(zero) and quit PAUSE state, control station then goes to carry out lubrication operation.

There are two types of pause modes, TIMER mode and COUNTER mode for user to choose from.

**Timer mode**: In this mode, the variable of PAUSE parameter is time. On operation panel, the programmable range for PAUSE time is 0 to 999.9 hrs. If network command control is adopted, then the programmable time range will be 0 to 4 294 967 295 s.

**Counter mode**: In this mode, the variable of PAUSE parameter is the quantity of pulses. And the counting pulses are inputted from its channel's signal input terminal.
From operation panel, the programmable pulse range for PAUSE is 0 to 9999. If network command control is adopted, then the programmable pulse range will be 0 to 4 294 967 295 s.

**Special PAUSE parameter setup:** Set PAUSE parameters as some special parameters can realize some special control functions.
If PAUSE parameter is set as 0 (zero), then its channel will operate in LUBE state all the time and will not change to PAUSE state.
If PAUSE parameter is set as FFFF FFFFH ( 4 294 967 295 ), the relevant channel will stay in PAUSE state all the time. In this case, no matter what control mode is set, control station ignores it and the preset parameter value will not be decreased progressively. Only user manual operates the control station on panel (insert lubrication) , or to send function code 05H via network can force the system carry out lubrication operation once. But when this lubrication period finish, system returns to PAUSE state and stay in this state.

This function is very useful for intelligent lubrication system. The channel with this setup only performs lubrication work under host machine's integrating control; it will not turn to LUBE state automatically.

### 3.2 LUBE mode

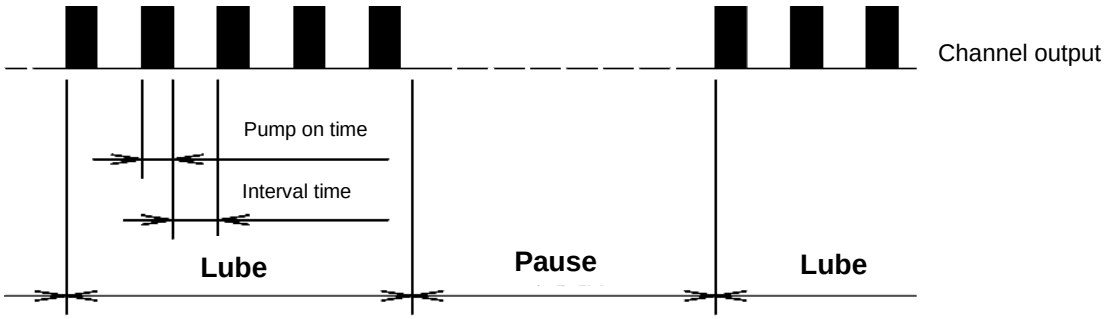
There are three LUBE modes available. They are TIMER mode, COUNTER mode and PULSE BURST mode.

**TIMER mode**: During lube time, channel supplies continuous current to pump or oil feeder, and the lube remain parameter decreases progressively with time as variable. On operation panel, the programmable range for LUBE time is 1 to 9999 s. If network command control is adopted, then the programmable time range will be 1 to 65535 s.

**COUNTER mode**: During lube time, channel supplies continuous current to pump or oil feeder, and lube remain parameter decreases progressively with pulse number as variable. And counted pulses are input via this channel's signal input terminal.
On operation panel, the programmable range for LUBE pulse is 0 to 9999. If network command control is adopted, then the programmable pulse range will be 0 to 65535.

**PULSE BURST mode**: Only LUBE control can use pulse burst mode.

The operational principle of pulse burst mode is: when gets into LUBE state, lubrication channels first get in current on (pump on) status and supply current to pump or oil feeder, meanwhile, LUBE time decrease progressively. When the current on time finish, system then goes to interval time and electricity to pump or oil feeder is cut off. Interval time decreases progressively at the same time. When interval time countdown to the end, the remain parameter of LUBE decrease 1. If the LUBE parameter has not decreased to 0 (zero), system then returns to current on state….these circles last to LUBE parameter decrease to 0 and LUBE period finish.




This lube mode is to send a series pulses to pump or oil feeder during lube

time, so this control mode is also called pulse burst mode. Pulse burst quantity, pulse current on (pump on) time and interval time are programmable.

On operation panel, the programmable range for pulse burst quantity is 1 to 9999. Pulse current on time is 0.01-99.99s. Interval time is 0-99.99s.

If network command control is adopted, then the programmable pulse burst quantity can be 1 to 65535, pulse current on time is 0.01-655.35s, interval time is 0.01-655.35s.

### 3.3 Inserted lubrication

Inserted lubrication function is required during the lubrication system's installation, test or debug. Control mode, parameter and monitoring mode is same as normal lubrication cycle. Inserted lubrication can be activated from operation panel all the time. Differ from standard lubrication process; inserted lubrication can be aborted at any time.

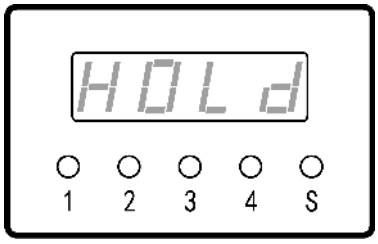
If an inserted lubrication is aborted, preset monitoring function may not work.

Please refer to chapter 4.3 for detailed information on how to start and stop the inserted lubrication.

## 3.4 External interlock control

Lubrication station supports external interlock control. When external interlock signals are effective (interlock switch closes or external control terminal inputs high level), lubrication station performs lubrication control function and fault detection function normally. When external interlock signals are invalid, lubrication control and fault detection function will be halted. Once external interlock signal return to effective again, control station will free from halt state and continue carries out lubrication control and fault detection function.

When control station is in halt state, view the current status, LED monitor displays "HOLd".




External interlock control function can be activated or deactivated via operation panel or network control command.

### 3.5 Power off protection function

The control station has power off protection function. Once this function is activated, whenever the power is cut off, the control station automatically saves operating status and remaining values at the point of power-off. When next electrify starts, the control station will continue carrying out operation from last state of the power off.

The control station stores operating status and rest parameters in EEPROM. The data can reliable be stored for 25 years.

Power off protection function can be activated or deactivated via operation panel or network control command.

The trigger voltage for power off protection function can be modified via network command. **Please note**: this trigger voltage must be setup within a reasonable range, which can guarantee the power off protection acts timely and effective (the trigger voltage should not be too low) and also guarantee the control station will not be too sensitive and the power off protection function couldn't be triggered frequently by normal voltage fluctuation (this requires the trigger voltage should not be too high)

If the controlled facilities and the control station are not power supplied by the same power source, this function must be used with caution since it may cause control station and controlled facilities cannot work synchronously.

### 3.6 Analog signal input

Control station UC-3N has 4 external analog signal input channels. Input signal range is 0-20mA, which can be used to measure 4-20mAindustry standard current signals, to connect to standard industry transmitters like pressure, temperature and flow, which makes the host machine aware the real surrounding situation.

After the analog signals are converted by A/D converter, they can be used by the control system to measure analog signal. There are no corresponding relationship between the 4 channel numbers of the analog channels and the 4 channel numbers of the control channels.

A/D converter resolution of the analog signal is 0.1%( 1/1024 ), conversion speed is about 10ms/time, the conversion result is digital filtered, user do not need to filter it again.

Analog signal can be read from network interface. There is no relative information displayed on the operation panel.

Control station UC-3N can measure voltage and working environment temperature of itself, and these measurement results also can be read from network interface.

# 4. Operation guide

Control station UC-3N using LED monitor and LED indicator lights to indicate operation parameter and status.
Ordinarily LED indicator lights indicate status. By press key to start view parameter mode. Then user can select the specific channel to view its status, control mode and rest parameter, and also can change channel's status in view mode.

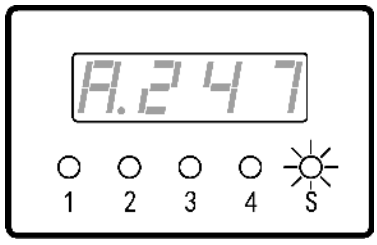
## 4.1 LED indication

There are 5 indicator lights on the operation panel, 1，2，3，4 and S. Among them, indicator lights 1，2，3，4 are used to indicate each channel's working status. When the channel is in PAUSE state, the corresponding indicator light is off. When the channel is in LUBE state, the corresponding indicator light is on. When fault is detected in this channel, the indicator light will be flash.
Indicator light S is used to indicate system status and network activity condition. When the power supply to the control station UC-3N is normal and system operates properly, light S is on. When control station UC-3N has activities to receive or send network data, light S is flashing. The flicker frequency and data receive and send frequency is directly related.

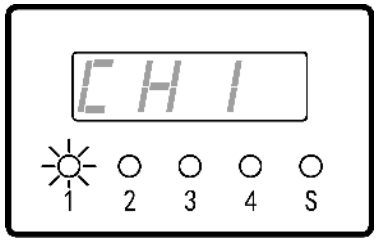
## 4.2 Start display mode

**1.** Press key to get into view mode. Light S is on. Meanwhile, LED monitor shows the control station's station number/ address. The station number form is A.XXX

**Example:** Station number is 247

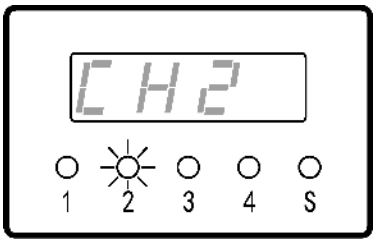



**2.** Press key , LED monitor displays CH1 and light 1 is on, which means user can choose one of the 4 channels to check detailed parameters.



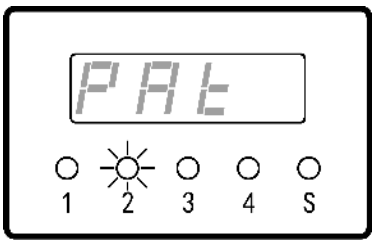
**3.** Press key to switch in the 4 channels, LED monitor shows the channel information that user selected and the corresponding light is on,

**Example:** select channel 2.

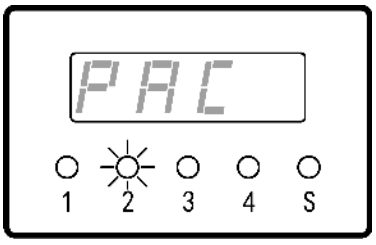



**4.**Press key to confirm the selected channel.

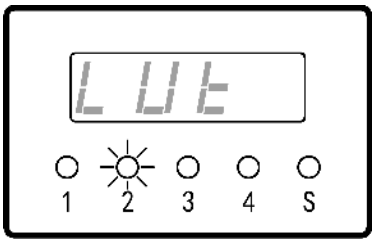
LED monitor then begin to show the current state and control mode of this channel. The possible displayed content is PAt – **PA**USE state (**PA**)**,** control mode is **t**imer (**t**)



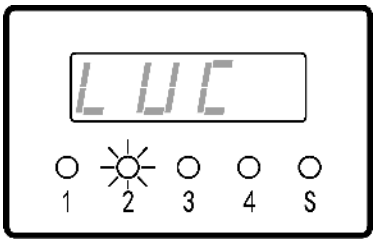

**Or** PAC – **PA**USE state (**PA**), control mode is **c**ounter (**C**)



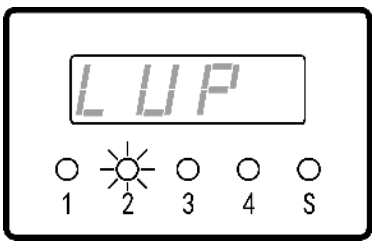

LUt – **LU**BE state (**LU**), control mode is **t**imer (**t**)



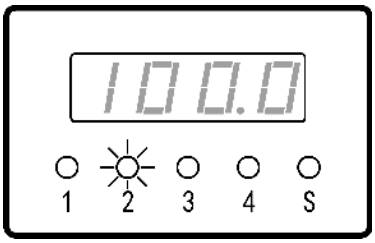

LUC – **LU**BE state (**LU**)**,** control mode is **c**ounter (**C**)




LUP – **LU**BE state (**LU**)**,** control mode is **p**ulse burst (**P**)

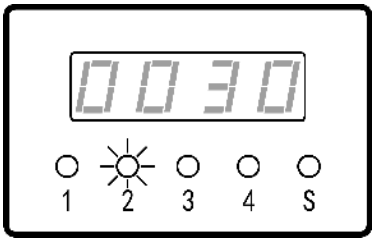


**5.** Press key , displays the rest parameter for current state.

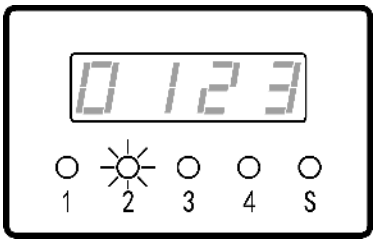



If it is PAt ( PAUSE, timer ) state, the measurement units of the displayed parameter is **hour.**

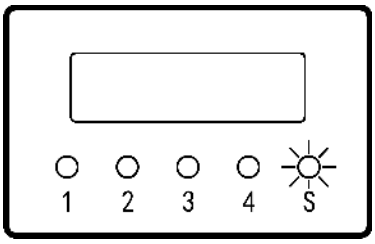
If it is LUt ( LUBE, timer ) state, then the measurement units of the displayed parameter is **second**.




For other states, displayed parameters' measurement units is counting times.




**6.** Press key , LED monitor goes off, and view mode ends. Control station backs to display state.

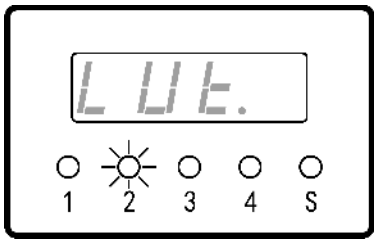



For error indication, please refer to chapter 7 < FAULT> .

If LED monitor shows FFFF during the view parameter mode, this means the real parameter is beyond the LED monitor's display range. (For example, the maximum parameter can be displayed on LED monitor is 9999. But the original lubrication control parameter has been modified to 10000 via network command, and this new parameter is beyond the LED monitor's display range. ).

### 4.3 Switch of inserted lubrication cycle

To start and abort an inserted lubrication in view parameter mode. Carry out steps 1-4, selected the channel, when then LED monitor displays the current state of the selected channel, press key ◀, if the channel is not in inserted lubrication state, then this operation will start an inserted lubrication; if it is already in inserted lubrication state, this operation will abort the inserted lubrication.
If a channel is in inserted lubrication state, then the corresponding working state displayed on LED monitor for this channel is ‘LUt**.’,** the suffix ‘.’(dot) is added to LUt to show this is an inserted lubrication state, and to differ from the normal lubrication state.




Inserted lubrication has very high priority. Unless system is halted ( or interlock open), user can start an inserted lubrication in any other states.

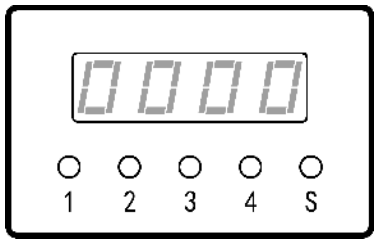
# 5. Programming

In order to meet different lubrication control applications needs, lubrication control station UC-3N can be programmed according to different lubrication requirements.
Programming can be done via both operation panel and network command. In this chapter, we only introduce to program via operation panel. But due to the display range of the LED monitor is limited, the range and content can be programmed via operation panel have some limits. Please pay attention to this.
Programming is divided into 4 parts: 1、program for PAUSE; 2. Program for lubrication; 3. Program for monitoring; 4. Program for system setting.

Please note: Programming always starts with steps 1-3.

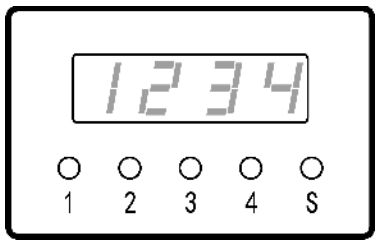
### 5.1 Start programming mode

**1.** Press key longer than 2 s, all signal lights off. LED monitor displays 0000, to input password now.

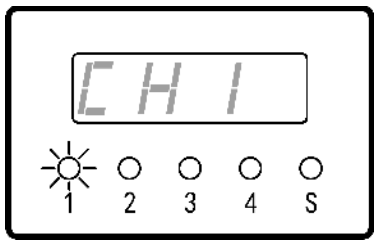



**2.** Use key to change the password.

**Example**：Change to 1234



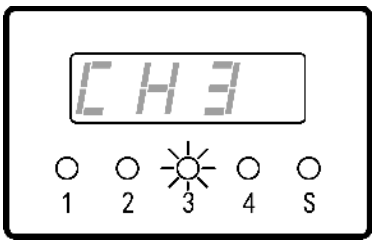

**3.** Press key to confirm the password. If it is correct, LED monitor then displays 'CH1', signal light No. 1 is on. If password is wrong, UC-3N exits password input state.



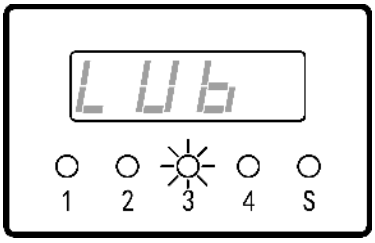
## 5.2 Program for Lubrication

**4.** Repeatedly press key , select the channel to be programmed. LED monitor displays channel number and the corresponding indicator light is on.

**Example:** select channel 3

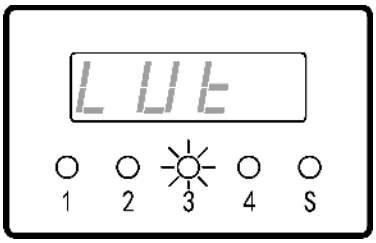



**5.** Press key to confirm the selected channel. LED monitor displays 'LUb'.




**6.** Press key to confirm to program for lubrication parameters.
LED monitor shows the preset lubrication control mode.

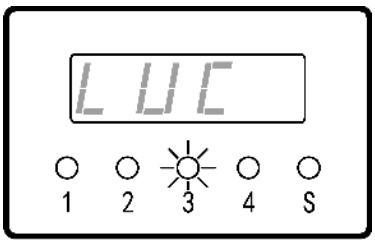
**Example:**
Original control mode is timer (LUt )




**7.** Use key to select other lubrication control mode.

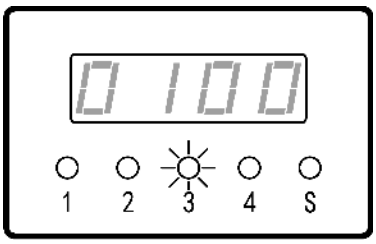
**Example:**

Select counter control mode ( LUC )

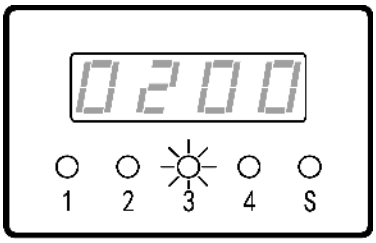



**8.** Press to confirm the new control mode. LED monitor then displays original control parameter.

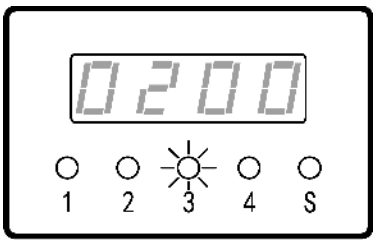
**Example**： 100 counting times



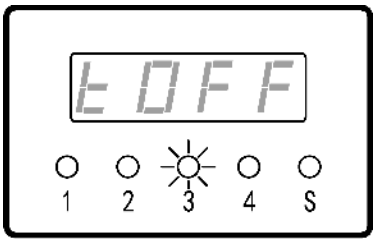
**9.** Use key to modify lubrication control parameter value.
**Example:** change to 200 counting times.




**10.** Press key to confirm the new parameter. If lubrication control mode is set as timer or counter, then skips to step18. Otherwise, goes to next step.

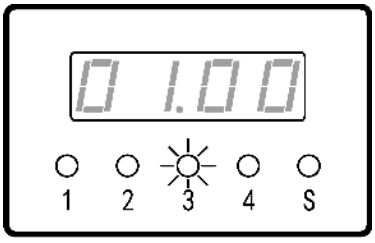



**11.** LED monitor displays ‘tOFF’, remind user to program for pulse interval time.



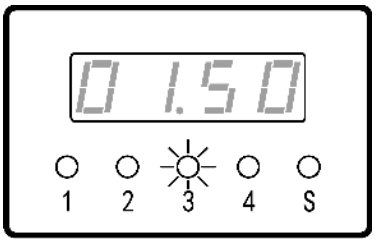

**12.** Press key , LED monitor shows original interval time.

**Example**:
Original pulse interval time is1s.

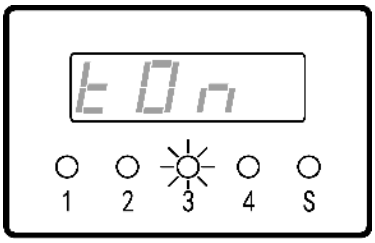



**13.** Use key to modify the interval time.

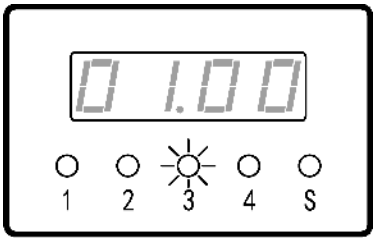
**Example:** Change to 1.5 s.



**14.** Press key to confirm the new interval time. LED monitor shows ‘tOn’, which remind user to program for pulse current on (pump on) time.

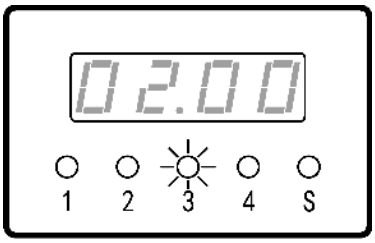



**15.** Press key , LED monitor displays original pulse current on time.
**Example:** original time is 1 s.

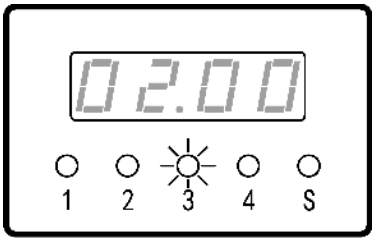



**16.** Use key to change pulse current on time.

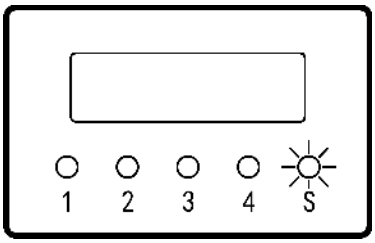
**Example**: Change to 2 s.




**17.** Press key to confirm the new pulse current on time.




**18.** New settings are saved permanently. LED monitor goes off and programming finish. Control station returns working state indicating state.

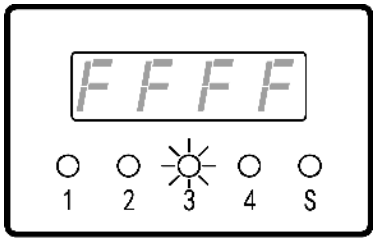


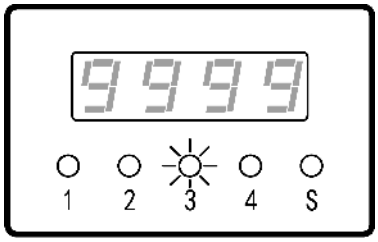
**Note**:

If LED monitor shows FFFF during the view parameter mode, this means the real parameter is beyond the LED monitor's display range. ( For example, the maximum parameter can be displayed on LED monitor is 9999. But the original lubrication control parameter has been modified to 10000 via network command, and this new parameter is beyond the LED monitor's display range. ).

In case of this, programming should be done with caution. Because if user change the parameter, this will change the parameter that was set via network command. And due to the LED monitor has no enough display range, once user changes it, it is impossible to set it back again.

When parameter is displayed 'FFFF' and user DOES need to change it, press key , LED monitor shows '9999', '999.9' or '99.99' according to different programming content. And cursor begins to blink. Now user can modify the parameter.
When parameter is displayed 'FFFF' and user DOES NOT need to change it, the press key directly. Control station will skip this setting.

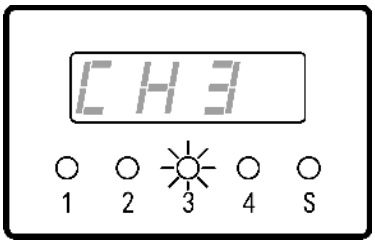


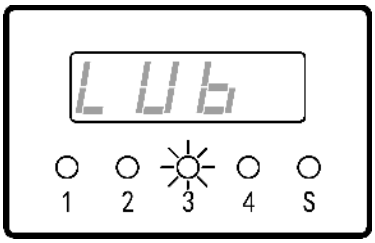
### 5.3 Programming for PAUSE

**4.** Repeatedly press key , select the channel to be programmed. LED monitor displays channel number and the corresponding indicator light is on.

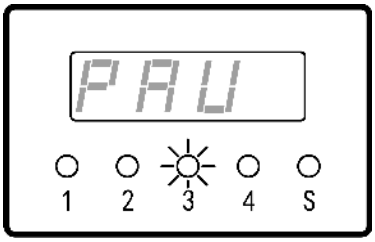
**Example:** select channel 3




**5.** Press key to confirm the selected channel. LED monitor displays ‘LUb’.

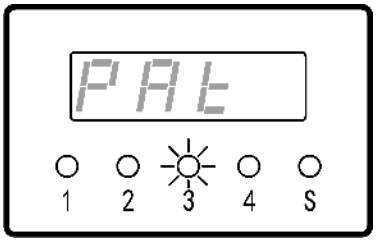



**6.** Repeatedly press key till LED monitor displays ‘PAU’.



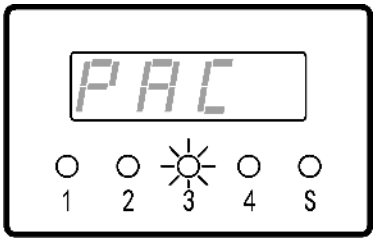

**7.** Press key to confirm the programming content is relate to PAUSE. LED monitor shows preset PAUSE control mode.

**Example**：Original PAUSE control mode is timer. (PAt )

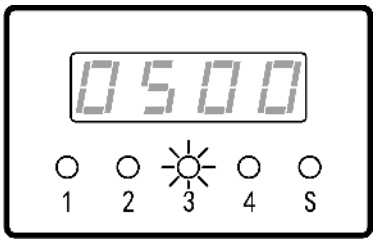



**8.** Use key to confirm the new pause control mode.

**Example**：Select Counter control mode ( PAC )

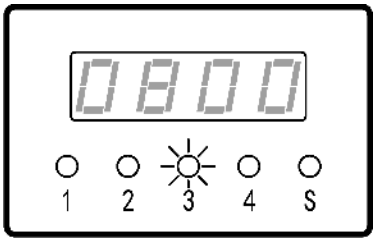


**9.** Press key to confirm the new pause control mode. LED monitor shows original pause control parameter value.
**Example:** 500 counting times

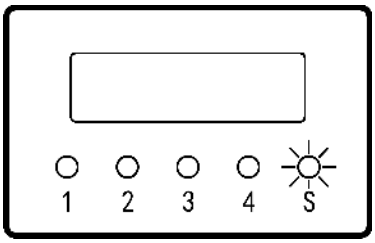



**10.** Use key to change pause control parameter value.

**Example**: Change to 800 counting times



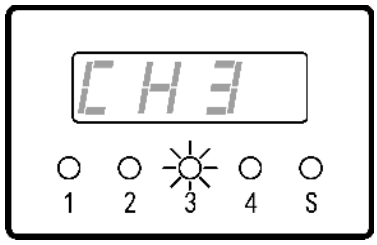

**11.** Press key to confirm the new PAUSE parameters. New settings are saved permanently. LED monitor goes off and programming finish. Control station returns working state indicating state.



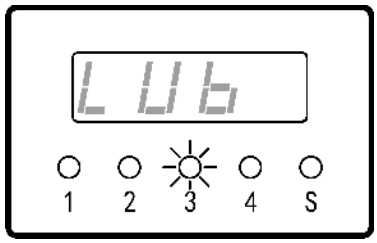
### 5.4 Programming for signal monitoring

**4.** Repeatedly press key , select the channel to be programmed. LED monitor displays channel number and the corresponding indicator light is on.

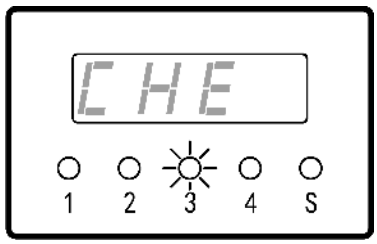
**Example:** select channel 3




**5.** Press key to confirm the selected channel. LED monitor displays 'LUb'.

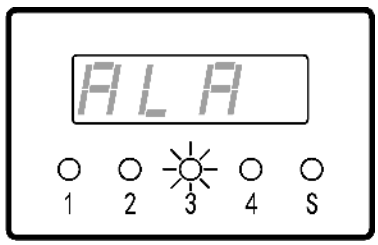



**6.** Repeatedly press key till LED monitor displays 'CHE'.




**7.** Press key to confirm. LED monitor shows preset signal monitoring mode.

**Example:** Original signal monitoring level is ALARM (ALA).

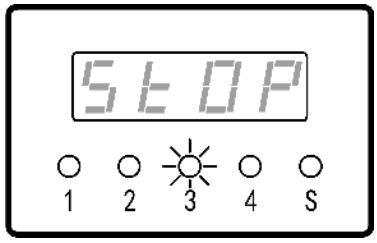



**8.** Press key to select other monitoring levels.

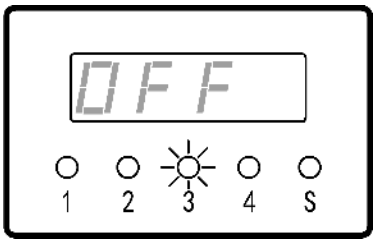
Options are:

OFF ( OFF ), Alarm ( ALA) or Stop ( StOP )

**Example**: Select stop ( StOP )

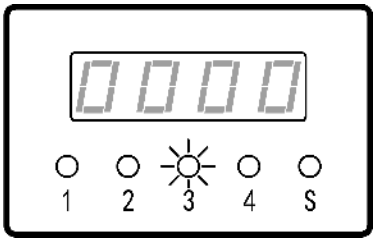


**9.** Press key to confirm the new monitoring level.
If OFF is selected, then skip to step 13. Otherwise, go to step 10.



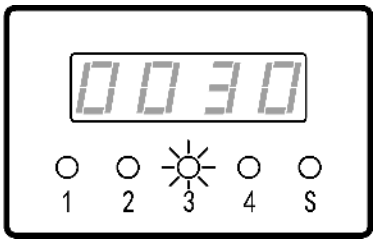

**10.**LED monitor shows original monitoring parameter.

**Example**：0

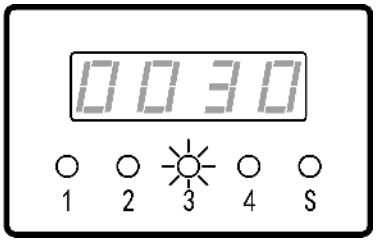



**11.** Use key to modify monitoring parameter value.

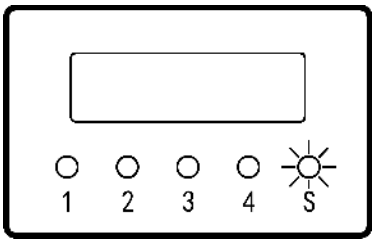
**Example:** Change to 30 s




**12.** Press key to confirm the new monitoring parameter value.




**13.** New settings are saved permanently. LED monitor goes off and programming finish. Control station returns working state indicating state.

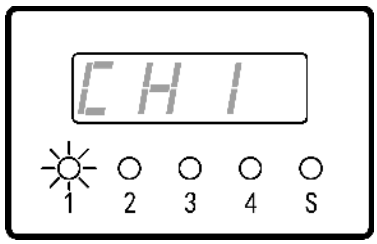


### 5.5 System parameters configuration

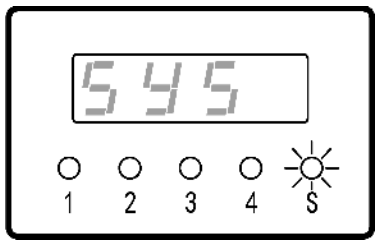
System corresponding parameters include network communication, system monitoring and password setup. No matter which parameter to be programmed, user has to input password to get into system menu for programming.

#### 5.5.1 Get into system menu for programming

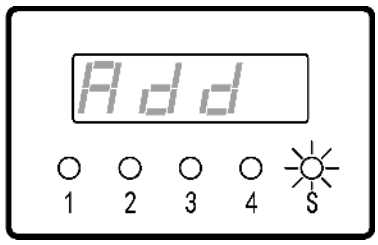
**4.** Press key , select the channel to be programmed. LED monitor shows the channel number and corresponding indicator light is on.




**5.** Repeatedly press key till LED monitor displays ‘SYS’ and indicator light S on.



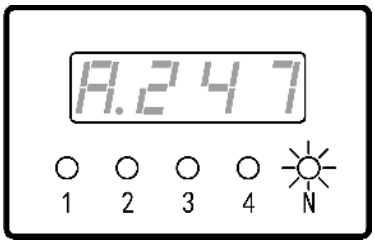

**6.** Press key to get into system configuration menu. LED monitor shows ‘Add’, and indicator light S remains on.



### 5.5.2 Set station number and address

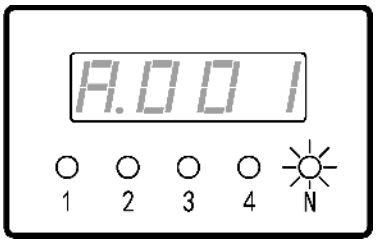
**7.** Press key , LED monitor shows the current station number address.

**Example:** Current station number address is 247

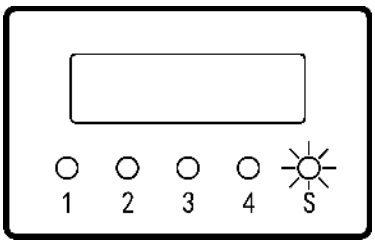



**8.** Use key to modify station number address.

**Example:** change to 1



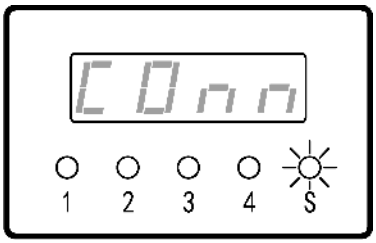

**9.** Press key to confirm the new station number address. New setting is saved permanently. LED monitor goes off and programming finish. Control station returns working state indicating state.



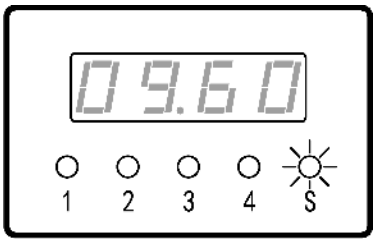

Station number address range is 1-247. If user input an address other than this range, control station has no reaction after press key .
Station number address configuration must be done with caution, this because this can affect network master address calling each control station. Moreover, user has to be sure that the station number must be unique. If there are two or more control station are addressed same station number, it will cause network address confusion and paralysis.

### 5.5.3 Programming for communication parameter

**7.** Repeatedly press key till LED monitor shows ‘Conn’.

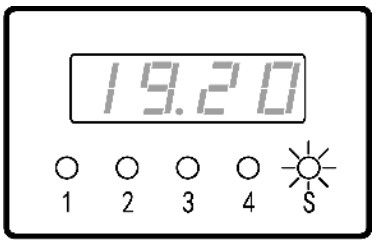



**8.** Press to get into communication parameter setting menu. LED monitor displays the current communication baud rate.
**Example:** Current baud rate is 9.6k bps



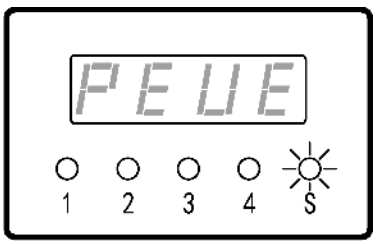

**9.** Use key to select new baud rate.

**Example:**
Select a new baud rate 19.2k bps



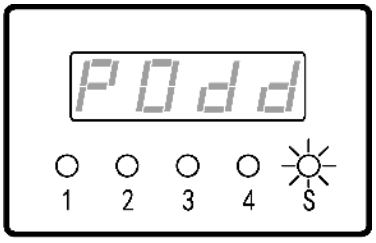

**10.** Press key to confirm the new baud rate. LED monitor then shows current parity setting.

**Example:** Current parity mode is even.

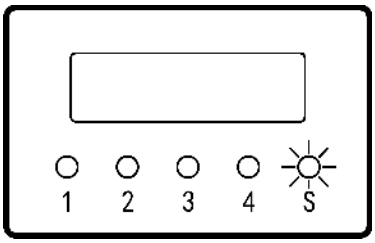



**11.** Use key to select the new parity mode.

**Example:** Select odd parity mode POdd



**12.** Press key  to confirm the new communication parameter. New setting is saved permanently. LED monitor goes off and programming finish. Control station returns working state indicating state.

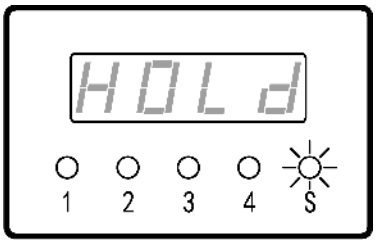



Please refer to chapter 6 <network control> and appendix 1 <MODBUS network communication protocol of UC-3N> for detailed meaning of communication parameters.

Communication parameter must be done with caution. Incorrect configuration will result in network master cannot communicate with control stations.

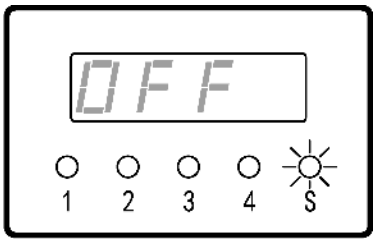
### 5.5.4 programming for external interlock control

**7.** Repeatedly press key till LED monitor shows ‘HOLd’.



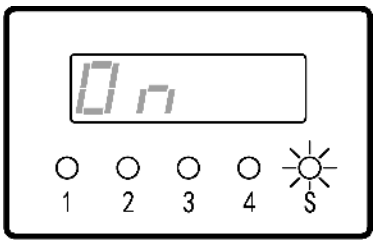

**8.** Press key , control station then displays preset external interlock control parameter.

**Example:** Current parameter is OFF

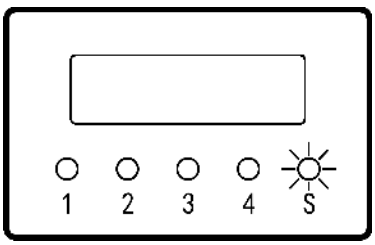



**9.** Use key to change the external interlock control parameter.

**Example**: ON.

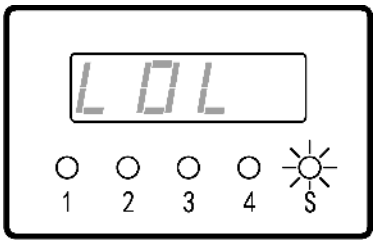



**10.** Press key to confirm the new external interlock control setting. New setting is saved permanently. LED monitor goes off and control station restarts to make the new external interlock control setting come into effect.



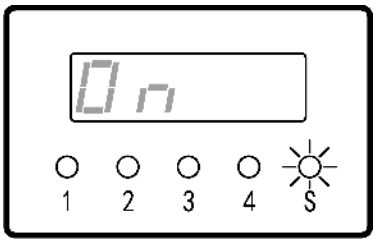
### 5.5.5 Oil level monitoring setting

**7.** Repeatedly press key till LED monitor shows ‘LOL’



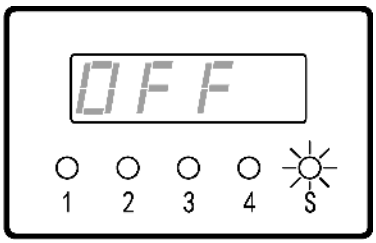

**8.** Press key , LED monitor then shows the oil level monitoring setting menu.

**Example:**
Oil level monitoring is set as ON

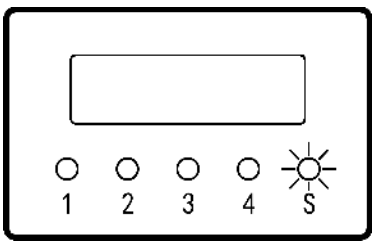



**9.** Use key to change the setting.

**Example**: Change to OFF

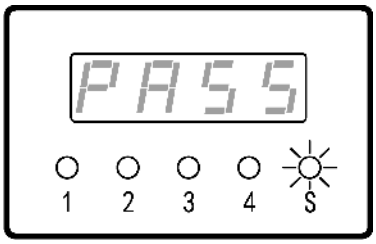



**10.** Press key to confirm the new oil level monitoring setting. New setting is saved permanently. LED monitor goes off and control station restarts to make the new oil level monitoring setting come into effect.



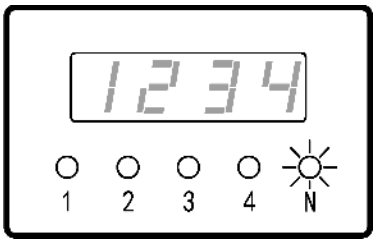
### 5.5.6 Set Password

**7.** Repeatedly press key till LED monitor shows ‘PASS’.



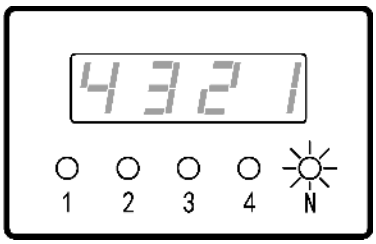

**8.** Press key to get into set password menu. LED monitor displays present password.

**Example**: Present password is 1234

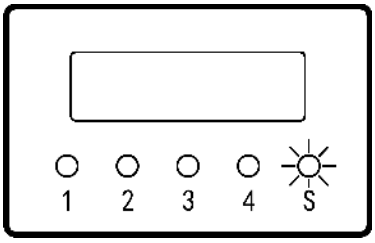



**9.** Use key to change password.

**Example**: New password is 4321




**10.** Press key to confirm the new password. The new setting is saved permanently. LED monitor goes off and control station quits programming mode and returns working status indicating state.




**Please note:**
The password should be kept in a safe place. If the password gets lost, the programming of parameters for the control station is impossible. In case of that, please contact manufacturer. Manufacturer’s contact information is printed on fly page of the User’s Manual.

# 6. Network control

Control station UC-3N owns networking capability. With commands from the host via network, more control stations can form a large distributed lubrication control system, to supply control support to large scale industrial applications with complicated lubrication systems like metallurgy, port, mine, power mill and petrochemical etc..

Basic knowledge of computer, network, Electrical and electronic is required to read this chapter.

## 6.1 Networking condition and capability

Control station adopts RS-485 bus. It realizes network control via industry standard MODBUS protocol. RS-485 bus is the widely used control bus in industry. One RS-485 bus can address up to 32 slaves at Baud rate 9600bps to a maximum wiring distance capacity of 1200 meters. In recent years, the industry has greatly expanded these conditions by technology progress. By using devices like enhanced interface, 455 repeater and 485 HUB etc., RS-485 system can support to connect 400 devices at the most; communication distance can be expended up to 3000 meters.

MODBUS is a commonly used industrial communications protocol. It has been improved that it is a simple, efficient and reliable protocol.

Due to its remarkable adaptability, it is especially suitable for industry application and it has been supported by any manufacturers.

UC-3N use standard 485 interface, at the same time, we enhanced the reliability and stability of the interface. For example, we use isolated power supply to improve its adaptability to the high common-mode voltage of industrial occasions, use interface protection technology to protect against lightening strike, overvoltage, short circuit and open circuit etc. All these measures dramatically enhanced the control station's reliable and steady network communication ability in complicated industry environment.

UC-3N complies with Modbus protocol, and it implements one subset of the standard Modbus protocol.

Networking capability of UC-3N is: 1-247 slaves; Baud rate 300，600，2400，4800，9600，14400，19200，38400; no parity, odd/even parity are available.

Control host is required to support 485 bus networking and can implement modbus protocol. Many PLC and industry control Computer are built-in support to modbus. It is easy to make them support MODBUS protocol by calling module or a simple configuration. Even if there are no ready-made modules, by simple programming PLC or IPC computer, it can also be achieved to support modbus Protocol

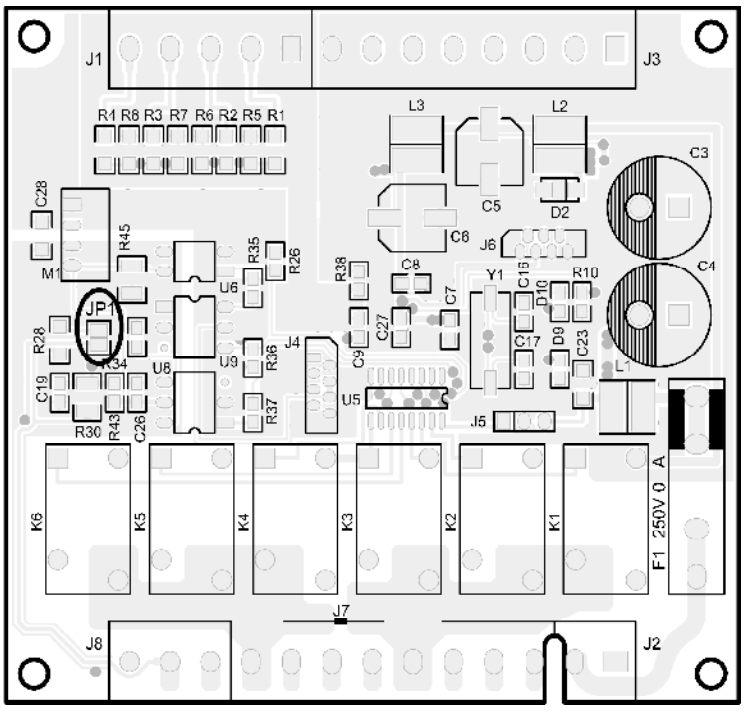
Due to control station UN-3N has powerful functions and high degree of autonomy, control tasks

can be done through small, simple communications instructions, the requirement to the host is not high. In UC-3N network, host just play a coordinating role, without intervention of the specific control work. This means PLC or IPC computer is unnecessary, even economic Industrial touch screen is capable to act as a host to work, to realize network control. Less network traffic can reduce the demands on the network, lower network costs and improve the reliability of communication and control.

Control station UC-3N's default station number is 247, baud rate 9600, even parity, 1 stop bit. In order to make sure that the control station can be added to the network correctly, user need to reset the address and communication parameters according to real situation before connecting it to the network.

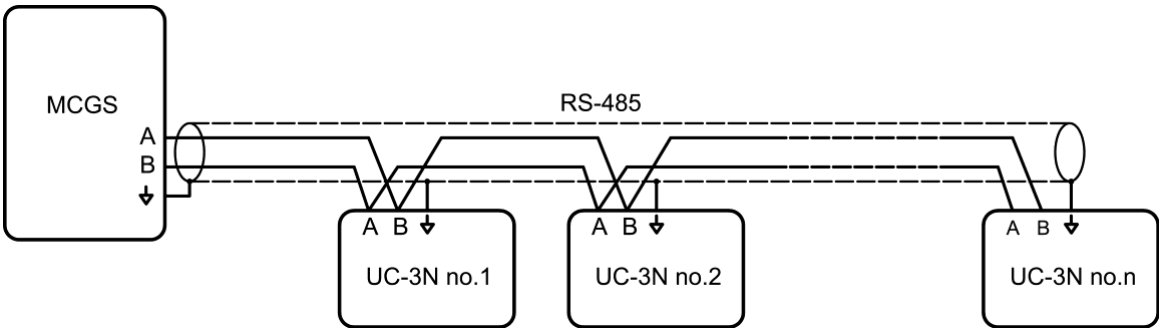
## 6.2 Network interface and wiring

UC-3N's network must be strictly comply with RS-485 wiring regulation. All control stations have to be connected to the network by hand in hand method, T-shape connection, star type connection and ring connection is not allowed. Non standard wiring will lead to the network job instability or even completely paralyzed.




In order to make the network signal transmission stable, for longer network ( >300m ), especially network with less equipments, 120Ω termination resistor has to be accessed to RS-485 interface of the first and the end control station.

We already prepared a 120Ω terminal resistor on UC-3N's PCB, but it is not accessed to network. Open UC-3N's box and take out the PCB, you will see there is a pair of empty pads (JP1) . Weld to short circuit this pair of pads with solder, the resistor then join the network. Please refer to the above drawing for the position of JP1.
Here is the network wiring method diagram when using MCGS industrial touch screen as the monitoring host.




Network cable must use minimum 0.5mm$^2$ Shielded Twisted Pair, and shielding layer should be properly grounded after connecting to RGND of each station to ensure network stability. The network cable should stay away from occasions of strong electromagnetic interference and **cannot** be laid parallel with power lines. If overhead laying is necessary, bearing support must be applied separately, it is prohibited to use network cable bearing itself. And, lightning protection measure has to be adopted strictly.

### 6.3 network function and instruction

After proper name the station number and set up communication parameter, correctly connected to the network, user then can control the system via network.
**Note**: **In** modbus communication, UC-3N can only be used as the slave, and cannot be used as host.
Indicator light S on the panel of the control station not only indicates power supply to the control station is ready, but also indicates network activities status. When data transmission is active, light S flash, the frequency of the flash is proportional to the data transmission flow. Observe this indicator light status can understand the network activity situation.

#### 6.3.1 Priority control

In UC-3, panel operation is prior to network control. Read data commands ( function code 02H, 03H, 04H ) are not affected by panel operation. But there are effects on write data and force status change commands as follows:.

If panel is under view parameter mode or programming mode, function code

05H( force status change ), 06H( preset single register) and 10H(preset multiple registers ) will be refused. Send function 05H, 06H or 10H at this time, control station UC-3N will response error code 06H ( slave device busy )。

If control station is now performing inserted lubrication control (this means the system is now under testing or debugging process), function 05H( force status change) will be refused. Send function 05H at this time, UC-3N will response error code 06H (slave device busy ).
If control station is in halt state ( external interlock control break )，function 05H( force status change )will be refused. Send function 05H at this time, UC-3N responses error code 07H (Negative acknowledge: slave cannot perform the query function).

### 6.3.2 Some regulations of the protocol

In order to simplify control work, UC-3N limits some terms of modbus protocol.

In UC-3N's MODBUS network communication protocol, some protocol addresses are preserved. Read or write these preserved address will receive response error code 02H (illegal data address). There are some read-only addresses. Write on these addresses will response error code 03H (illegal data).
In this protocol, UC-3N limits function 03H( read multiple holding registers ) to read one word (2 bytes) each time, if command asks a data more than 1 word, the command will be refused and response error code 03H (illegal data).
But some parameters ( such as pause parameter ) expression range exceeds one word and occupy two adjacent words. To read these parameters, high order word has to be read first, then low order word, combine the two segments to form a integral double word parameter. If read operation is not followed by this order, the result will be unpredictable.
For the same reason, using function 06H (preset single register) to perform write operation for a double words parameter, high order word must be write first, then low order word. Otherwise, the result is unpredictable.

In order to keep UC-3N compatible with modbus protocol, UC-3N supports function 10H (preset multiple registers). But, UC-3N limits function 10H that only one word can be preset each time. Actually, inside UC-3N, function 10H is performed as 06H. Therefore, If host sends the function 10H, in which the data is more than one word, UC-3N will response error code 03H (illegal data).
UC-3N realizes modbus protocol's subset 1 ( **Exception**：for the reason that UC-3N already supports to read channel status register, function 01H is not realized). If a function other than those functions supported by subset 1 is sent to UC-3N, it will response error code 01H (illegal function).

UC-3N's modbus protocol supports broadcast. Except some specific addresses,

function code 05H，06H，10H also support broadcast. With broadcast function can rapid deployment a control network.

For more information, please refer to appendix 1, 《UC-3N's MODBUS network communication protocol》。

### 6.3.3 Lubrication function instruction

All lubrication functions mentioned in this manual can be realized via network commands. But due to the specific features of network operation, the function realization is a bit different from panel operation. We hereby only introduce the differences.

**1、Read and control channel's status**

The present status of each channel can be read out from channel status address via function code 03H. But, **do NOT** try to read in status word into channel status address to change channel status, which will result in response error code 03H.

The right method to control channel status is to send function code 05H (force coil status) to slave. This function code can force any one channel change to lubrication status or pause status.

Function code 05H is very useful in intelligent lubrication system. With it code, we can control lubrication points one by one and will not be affected by preset lubrication parameter or pause parameter ( it is recommend to set pause control parameter value as FFFF FFFFH at this time to let network control takes over the channel)

With function code 05H, user can remote reboot the control station.

**2、How to handle fault message**

Through network, user can set monitoring level and monitoring parameters, or to read monitoring status. But it is strongly recommend that user should handle faults and clear fault messages at site, and not to send function code 05H to clear fault messages via network. Although the function coming from host can be accepted and performed by control station UC-3N, this cannot solve the real physical fault at site like impurities in lubricating grease blocked the greaser feeder.

**3、Parameters modification**

All control parameters can be modified via network. But every parameter modification should take into serious consideration. Due to the display range is limited, if the programmed parameter is beyond the display range of the LED monitor, the parameter and its rest parameter cannot be displayed properly.

UC-3N does not do double check on the orders sent via network. Therefore, user

should pay attention not to set parameters beyond the range when using network command. For example, if user set power off protection starting voltage as 0, then the control station cannot work.
Whenever modify parameters relate to monitoring and system control, user has to consider current status of control station and all channels. If the monitoring to be modified is now in fault state, it has to be forced return to normal states after modification.

### **6.4** Network problems and trouble shooting

For the reason that slave stations are located everywhere and they influence each other, it is not easy to find out the reason and handle it once there is any problem. And real network conditions are also varies. It is impossible to offer a unified solution. Here are some common principle treatments for reference.

If host cannot reach all control stations, user should check if there is any problem with the host's network wiring and its interface. If the host can reach control stations, but some one cannot be reached or unstable, the problem may be as:

1. Slave station number is wrong
2. Slave's communication parameters are different from host
3. Slave off line
4. Slave power off
5. Slave is too far away
6. Slave baud rate is too high
7. Slave receives strong interference
8. Slave occurs error

If above mentioned problems occur, user first need to check if slave control station is in order. By panel operation, to check if station number is correct and communication parameter is same as the host via programming function. If there is problem, reset these parameters.

If there is no problem with station addresses and communication parameters, please observe the light S on panel. If light S never flash, please first check if the net cable is right connected.

If net cable is normal, but light S does not flash, please check if slave is interfered by strong interference, or the communication distance is too far, baud rate is too

high. In case of this, disconnect the slave station from the network; use PC to connect 485-converter and the slave station, to test it separately. Can use test tool software (for example: use “modbus poll” or “**Serial debugging assistant”)** to send command string 0005FFFF0000CC3FH( Note： this is hexadecimal data. Test tool software must be set to send and receive hexadecimal data also), the slave station must answer the command and restart. This means the slave station itself is in good condition. Otherwise, please change slave station and return the faulty station to manufacturer for inspection.

If control station is in normal condition, please check if the network cable is interferenced and to eliminate the interference.

If there is no interference, please consider if the communication distance is too far or baud rate is too high. **Please note:** if the original network parameters are at critical, even the newly build network communicate well, with time passing and temperature changing, cable and facilities are aging. The network that originally worked well may become unstable. Thus, user cannot infer the network’s current condition with the formerly communication situation.

If it IS caused by this reason, please connect a repeater at a proper place. If it is inconvenient to connect a repeater, user may lower baud rate on the condition that normal lubrication control can be guaranteed.

UC-3N particularly optimized baud rate for lubrication control tasks, it supports lower baud rate to extend communication distance and to improve communications reliability.

If user uses 232-485 converter to connect host network, then active converter is required, and also need to confirm the baud rates that the converter supports. Some passive converter’s power capacity is insufficient, when communication distance is a little bit far or there are more slave stations, the communication will be failed.
Moreover, converter’s data transformation takes time. If converter does not support enough high and low baud rate, it may cause communication problems.

# 7. Faults

If the fault is global fault (for example: low level )

When control station UC-3N detects faults, corresponding LED indicator light on the panel will be flashing quickly (meanwhile, fault relay opens) to remind user the lubrication system is in fault. If the fault is a global fault (like low level) or channel's monitoring level is set as STOP, the corresponding channel will stop normal operation and wait for user to handle the faults.

User may check the detailed reason of the fault on LED monitor.

## 7.1 Oil level monitoring

Controller can detect oil level situation via oil level switch. When it detects the oil level is too low, oil level switch will open. Control station will give alarm when it detects the level switch open. And all channels get into stop state at the same time.

Oil level monitoring function can be deactivated via programming. Unless special requirement like facility debugging, it is not recommended to deactivate this function. Because this will put lubrication system in a very dangerous working condition due to the lack of basic fault monitoring capability.

## 7.2 signal monitoring

Each channel of UC-3N owns one signal input channel. Besides the counting signals input function, it also can be used as monitoring signal.

While signal input channel is set as counting signals input, it also can serve as monitoring signals input at the same time.

Monitoring signal has multiple monitoring levels and monitoring modes, which can flexibly meet different lubrication monitoring requirements.

There are three monitoring levels available:

**OFF**：to deactivate signal monitoring function；

**ALARM**：When control station detects fault, it only gives alarm signals (corresponding indicator light on panel flashes, fault relay opens) but operation is not stop.

**STOP**：When control station detects fault, it gives alarm signals (corresponding indicator light on panel flashes, fault relay opens) and the operation of the channel occurred fault stop.

Signal monitoring using a key parameter MONITORING TIME to realize monitoring function. Set monitoring time for each channel, and each monitoring

time manages one internal counter.

When lubrication process starts, the internal counter then start counting at the same time. During the counting period, the counter receives the change of monitoring signals from low to high (it is called signal raising edge), counter will make zero and restart counting; if counter cannot receive the signals raising edge, when counter's counting time reaches the preset monitoring time, control station will judge there is error occurred and gives alarm; if monitoring level is set as STOP, then control station will get the channel occurred error get into halt state.

Monitoring time's setting relates to specific lubrication monitoring mode. For Cycle Switch monitoring, it is suggested to use 1.5-2 times of cycle switch's action cycles; for counting signal monitoring mode, it is suggested to use 3-5 times of counting signals cycles; for pulse burst signal feedback monitoring mode, it is suggested to use pulse on time +interval time/2; ;for pressure switch monitoring mode, it is recommend to use a value that a bit less than lubrication time parameter value.

In the cases that it is not easy to define the monitoring time, user can set monitoring time as 0 (zero). This is special setting is called **follow up monitoring.** When monitoring time is set as 'follow up monitoring', the internal counter stops counting. Channels of the control station only detect the signal raising edges at pump off time. If signal raising edge occurs in the period, then monitoring passes. If no signal raising edge, then the channel will be judged as error occurred.

If lubrication is set as timer control mode, follow up monitoring detection will be carried out at the end of lubrication process. If lubrication is set as pulse burst control mode, the follow up monitoring detection will be carried out at the end of each pulse.

If lubrication control is set as counter control mode, follow up monitoring is not supported.

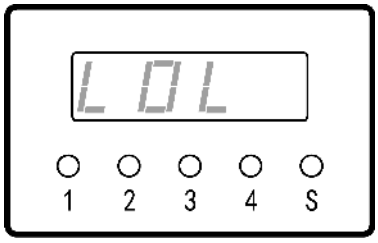
### 7.3 signal counting

Each signal input channel of UC-3N owns an internal counter, which carries out module 65536 plus count for its channel's. Counting range is 0-65535。User can use network command to read out the counting value of this counter, and to read in this counter with network command.
With this counter, we can understand some working states of the lubrication system. For example, in the intelligent lubrication system that uses non-circular gear flow meter to measure oil charge volume, control station controls the lubrication process by counting flow meter's pulses. When UC-3N receives

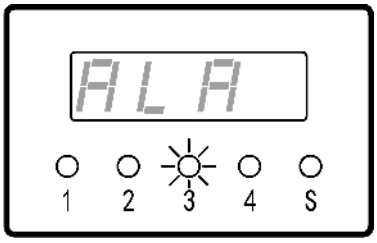
enough measuring pulses, solenoid oil feeder will close and lubrication process finish. In this situation, counter keeps receiving and counting flow signals. By reading this counter, host can judge the fault that solenoid oil feeder cannot close.

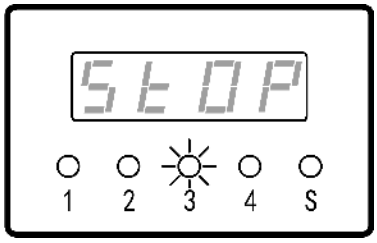
## 7.4 Faults display contents

When control station detects faults, indicator light of the corresponding channel will be flashing.
If **L**ow **O**il **L**evel error occurs, press key , LED monitor first shows the station address, then displays LOL(**L**ow **O**il **L**evel error).




If one channel occurs signal monitoring error, gets into view parameter mode, select the channel, according to preset different monitoring level, the error information displayed on the LED monitor will be ALA ( monitoring level is ALARM ) or **"SToP"** (monitoring level is STOP ).




When any channel occur any faults, originally closed fault relay will open to send out remote fault indication.
If the control station is network controlled, user can use network command to read detailed fault messages. Signal monitoring fault messages of each channel can be gained via reading channel signal monitoring status registers

## 7.5 Clear fault messages

Whenever the control station detects error, user must handle the error on time to avoid effecting lubrication's normal work. After the error is handled, clear fault messages and get the system back to normal operational state.

If Low Oil Level error (LOL) occurs, 4 channels' indicator lights on the panel will be flashing together. To clear the fault message, press key to get into view parameter mode. Press key again, when LED monitor displays LOL, press key , control station will exit low level fault state and goes to inserted lubrication state.
If one channel occurs signal monitoring error, after the error is handled, clear fault message. Clearance method is to press key to get into view parameter mode, press key to select the channel that occurred error. Press key , according to different signal monitoring settings, LED monitor displays ALA or SToP, press key , the channel occurred error quits fault state and gets into inserted lubrication state.

## 8. Technical specification

| | |
|---|---|
| Working voltage ---------- | 12V ~ 42V DC |
| Rated dissipation ---------- | < 4W |
| Drive Max. output ---------- | 5A，250V, AC |
| Lubrication control modes------ | Timer -T，Counter -C，Pulse burst -P |
| Lubrication time range---------- | 1 ~ 65535 s |
| Lubrication counting range----- | 1 ~ 65535 |
| Lubrication pulse burst range-- | 1 ~ 65535 |
| Pulse current on time ---------- | 0.01 ~ 655.35 s |
| Pulse interval time ---------- | 0 ~ 655.35 s |
| PAUSE control modes ---------- | Timer -T，Counter -C |
| PAUSE time range ---------- | 0 ~ 4 294 967 295 s |
| PAUSE counting range--------- | 0 ~ 4 294 967 295 |
| External input signal---------- | 10V~42V DC, input equivalent resistance 10k |
| Fault relay output ---------- | 250V AC，5A Max，N. C. |
| Analogue input ---------- | 0 ~ 20mA industrial current signals × 4 channels |
| Communication interface ------ | RS-485，asynchronous half-duplex |
| Communications protocol ------ | Modbus protocol ( subset) |
| Communications baud rate ---- | 300 ~ 38400 |
| Parity ---------- | No parity、Odd parity、Even parity |
| Working temperature ---------- | -25℃ ~ +70℃ |
| Working humidity ---------- | 20% ~ 90% no condensation water |
| Dimension ---------- | 90 × 115 × 72 mm |
| Weight ---------- | 218 g |

**Appendix** 1：

# UC-3N's MODBUS network communication protocol

## 1: Communication format

Control station UC-3N uses Modbus RTU protocol, data is transmitted by RS-485. modbus RTU communication format:

| start | address | Function code | Data field 1...n | CRC check code | end |
|---|---|---|---|---|---|

Address is 1 byte (Hexadecimal), valid range is 0~247, in which, 0 is broadcast address. Factory setting address is 247, when user wants to form a network with UC-3N, user need to readdress the slave stations according to their requirements.

The slave station's quantity of UC-3N network is 1~246 pieces, beyond the maximum quantity of RS-485 bus regulation. In order to guarantee the network operates reliable, 485 repeater or Hub is required to expend the networking control stations quantity and distance.

Function code is one byte (hexadecimal), to identify the function of each communication frame. UC-3N supports one subset of standard modbus function code. Please refer to the following chapters for the detailed definition.
Data field shows the content of the communication. The length will be different according to different function code.
CRC check code is a 2 bytes Cyclic Redundancy Check code. low-order byte is appended first, the calculation polynomial form of CRC-16 is $X^{16}+X^{15}+X^{2}+1$.

Messages start and end with a silent interval of at least 3.5 character times to validate the integrity of the message frame.

RS-485 interface mode is as follow:

Asynchronous half duplex communication. Default format for each byte is 8 data bits, 1 stop bit, even parity, Baud rate 9600.
Available baud rates are 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400
User can configure controllers for No Parity checking, Even or Odd Parity checking. Note: If No Parity is used, it is 2 stop bits; if Even or Odd Parity is used, it is 1 stop bit.

## Modbus function codes and address assignment supported by UC-3N

We hereby give some examples. Please note: all the samples we offer here using the factory default station number 247. If user wants to other number, please readdress the station and recalculate CRC check code.

**2: Read input status register**

Function code: 02H

It is used to read the input status of 6 switches of UC-3N. Broadcast is not supported.

| Address | Description | Read/Write | Meaning (figure in the description content is decimal) |
|---|---|---|---|
| 0000 ① | Input switch status | R ② | D0~D3 : 0~3 channel signal, D4-external control; D5-oil level; D6D7 invalid |

①In the above figure, address and data are all hexadecimal. Address is protocol address. Same as below tables.

② Read/Write: R-read only; W-write only; RW-Read and Write; －-reserved address, network Read/Write is not supported.

Address is 0000 only, readable bits are 1-8, but control station always responses 1 byte.

**Example:** data frame format

| address | Function | Starting address | | Read switch bits | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 02 | 00 | 00 | 00 | 08 | 6D | 5A |

Response frame format

| address | function | Bytes of response data | data | CRC parity code | |
|---|---|---|---|---|---|
| F7 | 02 | 01 | 31 | 53 | D4 |

Each bit status of the response data bytes represents the corresponding input status.

**3: Read holding registers**

Function code: 03H

It is used to read internal register of UC-3N. It is only allow to read out a data of one word (2 bytes) each time. Broadcast is not supported.

| address | description | R/W | Meaning (the figure in this meaning column is decimal figure. ) |
|---|---|---|---|
| 0000 | Station address | RW | Modbus address。Range 1~247 |
| 0001 | MODBUS protocol type | － | |
| 0002 | Communication baud rate | W | 1200, 2400, 4800, 9600, 14400, 19200, 38400 |
| 0003 | Parity | W | 'N'-no parity; 'E'-even parity; 'O'-odd parity |

| | | | |
|---|---|---|---|
| 0010 | Serial number (Low) | R | 0~9 9999 9999 |
| 0011 | Serial number (high) | R | Must read the high order, then low order |
| 0012 | Software version | R | The high byte is the primary version number, low byte is the minor version number |
| 0013 | language | – | |
| 0020 | System protection password | RW | Password range: 0000~9999 |
| 0021 | Power off protection setting | RW | 'N'-off, 'E'-on |
| 0022 | Power off protection starting pressure | RW | 0~1023, represents 0~50V |
| 0023 | External control setting | RW | Low-order byte 'N'-off, 'E'-on.Ignore high-order byte |
| 0024 | Oil level monitoring setting | RW | 'N'-off, 'E'-on * |
| 0025 | Monitoring state register | R | Low-order byte D7-power off protection state; D6-operational control state; D5-oil level monitoring state |
| 0100 | Current state of channel 1 | R | 'C'-lubricating, 'M'-inserted lubrication, 'P'-pause, 'H'-halt, 'T'-stop① |
| 0101 | Lubrication control mode of channel 1 | RW | 'C'-Counter, 'T'-Timer, 'P'-Pulse burst② |
| 0102 | Lubrication control parameter of channel 1 | RW | 1~65535 s or 1~65535 pulses |
| 0103 | Lubrication rest parameter of channel 1 | R | |
| 0104 | Pause control mode of channel 1 | RW | 'C'-counter, 'T'-timer |
| 0105 | Pause parameter of channel 1 (low) | RW | combine the high and low order bytes to get 0~42949 67295 s or 0~42949 67295 pulses③ |
| 0106 | Pause parameter of channel 1 (high) | RW | Must read high-order byte first, followed by low-order byte. |
| 0107 | Pause rest parameter of channel 1 (low) | R | |
| 0108 | Pause rest parameter of channel 1 (high) | R | Must read high-order byte first, followed by low-order byte. |
| 0110 | Channel 1 pulse time | RW | 1~65535, unit 10ms |
| 0111 | Channel 1 pulse time | RW | 0~65535, unit 10ms④ |
| 0112 | Channel 1 pulse ratio | – | |
| 0113 | Channel 1 injection tuning | – | |
| 0120 | Signal monitoring level of channel 1 | RW | 'N'-off, 'A'-alarm, 'T'-stop |
| 0121 | Signal monitoring state of channel 1 | R | 'N'-no fault, 'A'-alarm, 'T'-stop |
| 0122 | Signal monitoring parameter of channel 1 | RW | 0~65535 s |
| 0123 | Monitoring rest parameter of channel 1 | R | |

| | | | |
|---|---|---|---|
| 0124 | Channel 1 signal counting | RW | To do loop count based on modulo 65536 for signal rising edge. |
| 0200 | Current state of channel 2 | R | The orders of all parameters are same as those of channel 1. |

① In response data, low-order bytes ASCII character represents the current status of the channel.

② In the set or response data, low-order bytes ASCII character represents channel's control mode.

③ Pause parameter value across two data fields, it has to be divided into two segments to read/ write. Read/write high-order word first, then low-order word. Otherwise, the result is unpredictable.

④ Pump on time and interval time settings only take affects on pulse burst ('P') control mode. Although read/write also can be done under other control modes, the results of the read/write have no meaning.

**Example 1:** Read system monitoring status registers

Data frame format

| address | Function | Starting address | | Read out data quantity | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 03 | 00 | 20 | 00 | 01 | 91 | 56 |

Response frame format

| address | Function | Bytes of response data | Response data | | CRC parity code | |
|---|---|---|---|---|---|---|
| F7 | 03 | 02 | 00 | 40 | 71 | A1 |

Response data 0040H, the bit status of low order byte ( 01000000B ) represents corresponding monitoring status. D6 is 1, which means external control function is now playing its role.

**Example 2: Read the current status of channel 1**

Data frame format

| address | Function | Starting address | | Read out data quantity | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 03 | 01 | 00 | 00 | 01 | 91 | 60 |

Response frame format

| address | Function | Bytes of response data | Response data | | CRC parity code | |
|---|---|---|---|---|---|---|
| F7 | 03 | 02 | 00 | 43 | 31 | A0 |

Response data 0043H low-order byte is letter C's ASCII code, which represents channel 1 is now in lubrication state.

**Example 3:** Read lubrication rest parameter of channel 1

Data frame format

| address | Function | Starting address | | Read out data quantity | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 03 | 01 | 13 | 00 | 01 | 60 | A5 |

Response frame format

| address | Function | Bytes of response data | Response data | | CRC parity code | |
|---|---|---|---|---|---|---|
| F7 | 03 | 02 | 00 | 2A | 71 | 8E |

Response data 002AH is lubrication state's rest parameter. Convert it to decimal value is 42.

**Example 4:** Read channel 1's current rest PAUSE value by words. This has to be divided into 2 words to read, and high order word must be read first, followed low order word. Combine the high and low order to a double-word data.

Data frame format

| address | Function | Starting address | | Read out data quantity | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 03 | 01 | 24 | 00 | 01 | D1 | 6B |

Response frame format

| address | Function | Bytes of response data | Response data | | CRC parity code | |
|---|---|---|---|---|---|---|
| F7 | 03 | 02 | 87 | 65 | D3 | 8A |

Then read low order:

Data frame format

| address | Function | Starting address | | Read out data quantity | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 03 | 01 | 23 | 00 | 01 | 60 | AA |

Response frame format

| address | Function | Bytes of response data | Response data | | CRC parity code | |
|---|---|---|---|---|---|---|
| F7 | 03 | 02 | 43 | 21 | 81 | 79 |

Response date of read high-order byte is 8765H, and response data of read low-order byte is 4321H. Combine these two segments to form a 4 bytes hexadecimal value 8765 4321H, this is the pause rest parameter.

**4: Read input registers**

Function code: 04H

It is used to read the 4+1 analog input values of UC-3N. Broadcast is not supported.

| address | description | Meaning (the figure in this meaning column is decimal figure. ) |
|---|---|---|
| 0000 | The 1st analogue signal measuring value | Range 0~1023 represents 0-20mA① |
| 0001 | The 2nd analogue signal measuring value | |
| 0002 | The 3rd analogue measuring value | |
| 0003 | The 4th analogue measuring value | |
| 0010 | power voltage | 0~1023, represents 0~50.5V<br>**Voltage (V)=measured value × 0.0493** |
| 0011 | Controller's environment temperature | Control station temperature (℃)= measured value / 3.333-50 ② |
| FFFE | Input terminal status | Bit definition is as same as function code 02H. It is used to help those modbus masters who do not support function code 02H. |

① Analog is handled by first-order low-pass filter, accuracy is 0.5%, refresh rate is about 10ms/channel

② This function is available in enhanced version.

Read out data quantity is only 1.

**Example:** Read voltage

Data frame format

| address | Function code | Starting address | | Read out data quantity | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 04 | 00 | 10 | 00 | 01 | 24 | 99 |

Response frame format

| address | Function code | Bytes of response data | Response data | | CRC parity code | |
|---|---|---|---|---|---|---|
| F7 | 04 | 02 | 01 | EE | F0 | F9 |

Response data 01EEH is the current voltage value to the controller. Convert to real voltage is 24.2V

**5: Preset single register**

Function code: 06H

It is used to set UC-3N's internal register. Except the named station number

( address 0000 ), all the other addresses support broadcast.

The follow addresses that marked as PRESERVED are not allowed to read; those marked as READ ONLY are not allowed to write.

| Address | Description | Meaning (the figure in this meaning column is decimal figure. ) |
|---|---|---|
| 0000 | Station number | Modbus station number, range 1~247 |
| 0001 | MODBUS protocol type | preserve |
| 0002 | Baud rate | 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400 |
| 0003 | Parity | 'N'-No parity; 'E'-even; 'O'-Odd |
| 0010 | Production model | Read only |
| 0011 | Serial number(Low) | Read only |
| 0012 | Serial number(High) | Read only |
| 0013 | Software version | Read only |
| 0014 | Language setting | preserve |
| 0015 | System protection password | Range 0000~9999 |
| 0020 | Monitoring status register | Read only |
| 0021 | Power off protection setting | 'N'-off, 'E'-on |
| 0022 | Power off protection start voltage | 0~1023 |
| 0023 | External control setting | Low byte 'N'-off, 'E'-on |
| 0024 | Oil level monitoring setting | Low byte 'N'-off, 'E'-on |
| 0100 | Current state of CH1 | Read only |
| 0110 | LUBE control mode of CH1 | Low byte ‘C'-counter, 'T'-Timer, 'P'-Pulse burst |
| 0111 | LUBE control parameters of CH1 | 1~65535s or 1~65535 pulses |
| 0113 | LUBE remain value of CH1 | Read only |
| 0120 | PAUSE control mode of CH1 | Low byte 'C'-Counter, 'T'-Timer |
| 0121 | CH1 PAUSE value (Low) | Merge high and low order by 0~42949 67295 s or 0~42949 67295 pulses |
| 0122 | CH1 PAUSE value (high) | Must set high-order first, then low-order |
| 0123 | PAUSE remain value (Low) of CH1 | Read only |
| 0124 | PAUSE remain value (High) of CH1 | Read only |

| | | |
|---|---|---|
| 0130 | Pulse time of CH1 | 1~65535 /10ms |
| 0131 | Pulse interval of CH1 | 0~65535 /10ms |
| 0132 | Pulse ratio of CH1 | preserve |
| 0133 | Projection adjustment of CH1 | preserve |
| 0140 | Signal monitoring state of CH1 | Read only |
| 0141 | Signal monitoring level of CH1 | 'N'-Off, 'A'-Alarm, 'T'-Stop |
| 0142 | Signal monitoring parameter of CH1 | 0~65535 s |
| 0143 | Signal monitoring remain value of CH1 | Read only |
| 0144 | Signal counting of CH1 | Read only |
| 0200 | Current state of CH2 | All parameters order are as same as CH1 |

**Example 1:** Named address is 1

Data frame format

| address | function | Starting address | | Read-in data | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 06 | 00 | 00 | 00 | 01 | 5C | 9C |

Response frame format (data frame is an echo of the query)

| address | function | Starting address | | Read-in data | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 06 | 00 | 00 | 00 | 01 | 5C | 9C |

**Example 2:** Set control mode as counter mode for channel 1 ( 'C', ASCII 43H )

Data frame format

| address | function | Starting address | | Read-in data | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 06 | 01 | 10 | 00 | 43 | DC | 94 |

Response frame format (data frame is an echo of the query)

| address | function | Starting address | | Read-in data | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 06 | 01 | 10 | 00 | 43 | DC | 94 |

**Example 3:** Set lubrication control parameter 1000 (03E8H) for channel 1

Data frame format

| address | function | Starting address | | Read-in data | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 06 | 01 | 11 | 03 | E8 | CC | 1B |

Response frame format (data frame is an echo of the query)

| address | function | Starting address | | Read-in data | | CRC parity code | |
|---|---|---|---|---|---|---|---|
| F7 | 06 | 01 | 11 | 03 | E8 | CC | 1B |

**6: Force channel status change** ( force single coil)

Function code: 05H

It is used to force one of those four channels of UC-3N to change state.

Broadcast is supported.

| address | description | Meaning ( the digits in this column are decimal ) |
|---|---|---|
| 0000 | Channel 1 (CH1) state | The value of 1 requests the channel to be in lubrication state 'C' (counting mode). The value of 0 (zero) requests the channel go to pause state 'P'① |
| 0001 | CH 2 state | |
| 0002 | CH 3 state | |
| 0003 | CH 4 state | |
| FFFF | Reboot system | The value of 0 (zero) requests the system to reboot. Other values are invalid. |

① If the channel is in halt state 'H', it cannot perform this function, then it will response error code 07H; If user is carrying out local manual operation (the corresponding channel state is already 'M'), or user is programming/viewing menu, slave will ignore this query and response error code 06H (slave device busy).

Constants in data field regulated the forced channel states. The value FF00H force the channel is 1 (lubricating); the value of 0000H force the channel is 0 (pause). Write other values are invalid and slave will response error code 03H ( illegal data) .

**Example 1:** Address channel 1 as 0

Data frame format

| address | Function code | Starting address | | Control constants | | CRC parity codes | |
|---|---|---|---|---|---|---|---|
| F7 | 05 | 00 | 00 | 00 | 00 | D9 | 5C |

Response frame format (data frame is an echo of the query)

| address | Function code | Starting address | | Read-in data | | CRC parity codes | |
|---|---|---|---|---|---|---|---|
| F7 | 05 | 00 | 00 | 00 | 00 | D9 | 5C |

**Example 2:** Address channel 1 as 1

Data frame format

| address | Function code | Starting address | | control constants | | CRC parity codes | |
|---|---|---|---|---|---|---|---|
| F7 | 05 | 00 | 00 | FF | 00 | 98 | AC |

Response frame format (data frame is an echo of the query )

| address | Function code | Starting address | | Read-in data | | CRC parity codes | |
|---|---|---|---|---|---|---|---|
| F7 | 05 | 00 | 00 | FF | 00 | 98 | AC |

**7: Preset multiple registers**

Function code: 10H

It is used to set UC-3N's internal register. Except the named station number (address 0000), all other addresses support broadcast. Limited data quantity is 1.

Address same as 5: preset single registers

**Example:** named station number is 1

Data frame format

| address | Function code | Starting address | | | Data number | Bytes | Read-in data | | CRC parity codes | |
|---|---|---|---|---|---|---|---|---|---|---|
| F7 | 10 | 00 | 00 | 00 | 01 | 02 | 00 | 01 | 48 | 34 |

Response

| address | Function code | Starting address | | | Data quantity | | CRC parity codes |
|---|---|---|---|---|---|---|---|
| F7 | 06 | 00 | 00 | 00 | 01 | 15 | 5F |

**8: Error code**

Function code: slave received function code **+80H**

| Function code | description | Meaning ( the digits in this column are decimal) |
|---|---|---|
| 01 | Illegal function | The function code received in the query is not an allowable action for the slave. |
| 02 | Illegal data address | The data address received in the query is not an allowable address for the slave. |

| | | |
|---|---|---|
| 03 | Illegal data | The value contained in the data field is not an allowable value for the slave. |
| 06 | Slave device busy | Slave device is engaged. Typical reasons are the salve is busy in processing a local manual operation, viewing or setting parameters. |
| 07 | Negative acknowledge | The slave cannot perform the program function received in the query. For example, ask slave to perform force status change when channel is in halt state. |

If a slave receives a frame with CRC checking error, or a odd even parity error is detected during data transmission process, slave will keep silent.

**Example: response** "illegal data" frame format

| Address | Function code | Error code | CRC Parity codes | |
|---|---|---|---|---|
| F7 | **82** | 02 | D9 | 5C |

Response function code **82H** means slave detected error , error code is 02H(illegal data address).

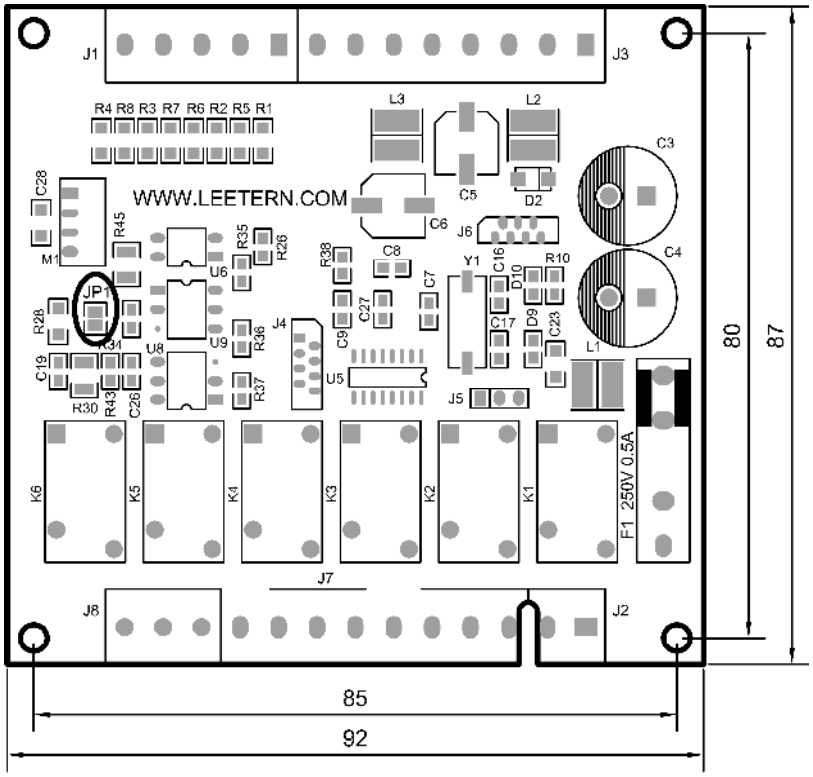
Appendix 2：

# Set of components of UC-3N

In order to meet user's needs, UC-3N can also be supplied as components, so that users can embed them in their own control station.

UC-3N consists of three parts: 1, main PCBA; 2, LEETERN general panel component; 3, FPC cable for connecting PCBA and panel.

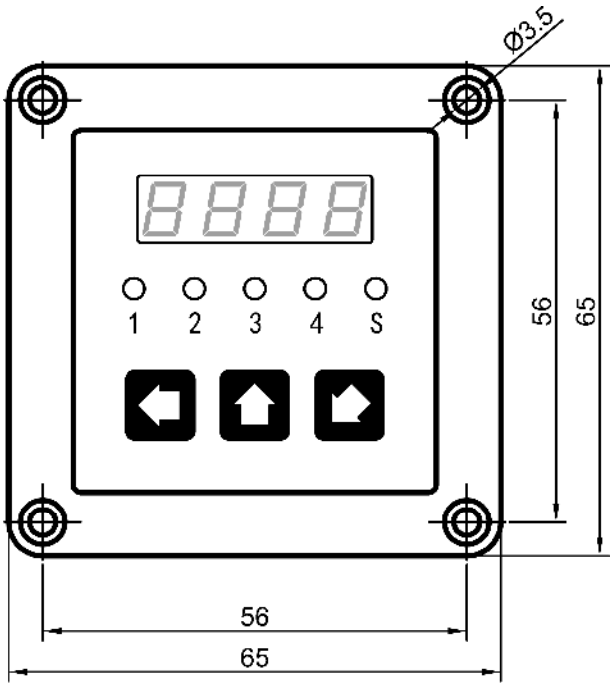
The set components of UC-3N is 133 g.
Installation dimension of the main circuit PCBA:



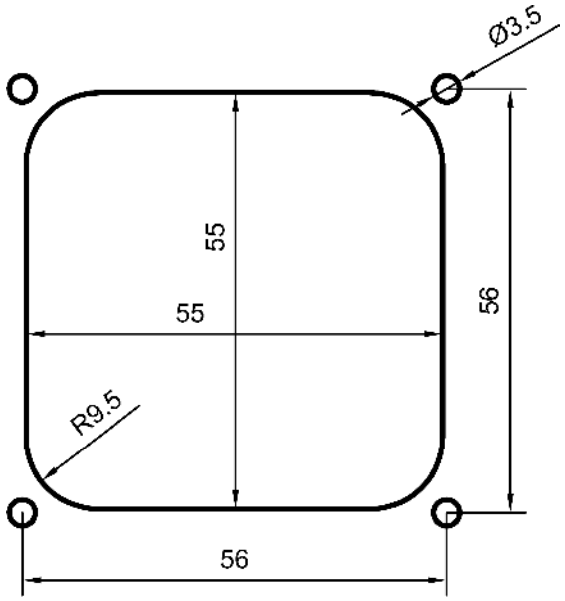

Maximum height of the PCBA is 25mm.

**Please note: If PCBA is installed on a metal baseboard and the equipment to be controlled is high voltage equipment, an 8mm (at least) net safety space between the metal baseboard and PCBA should be guaranteed to avoid the danger of electric shock.**

**Installation dimension**




General panel component's installation method is different from UC-3N's special panel, but LED monitor, pilot lights and keyboard are all same.
If users need to make opening on the box of their equipment to mount this panel, please refer to the panel CUT-OUT diagram as follow:




The 4 holes of Φ3.5 on the four corners are all unthreaded holes. It is recommend to use machine screws for them. If users want to use self-tapping screws to install the panel, then make the bottom hole as Φ2.4 and select ST2.9 self-tapping

screws.

Main PCBA and panel component are connected via FPC cable. FPC cable is not allowed close to strong EMI signal. To avoid the control station’s operation is influenced, FPC cable is prohibited to cross heavy current.