

DYX-FF Underground Fault Indicator	Version	V2.0.1
	Product Name	DYX-FF
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DYX-FF Underground Fault Indicator User Manual



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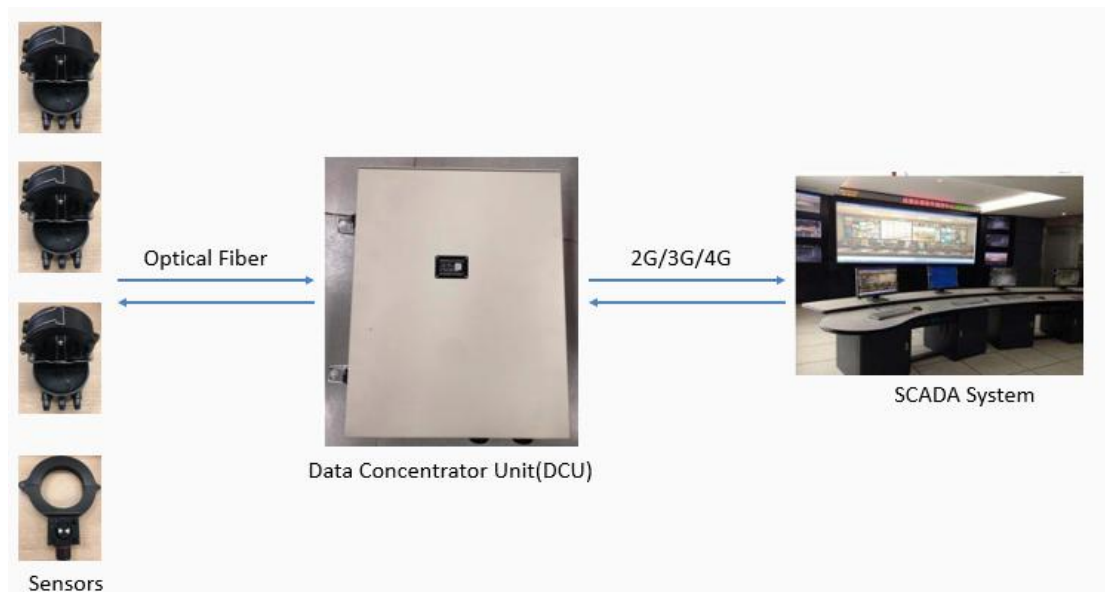
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1 DYX-FF Overview

The DYX-FF Remote underground fault indicator is used in 6~35KV cable line distribution networks, it is usually installed in Ring Main Unit, Cable Distribution Box, Switch Cabinet, and so on, enable the maintenance engineers to identify the faulty section of network and restore power supply to customers on healthy sections in the shortest time.

Short-circuit fault and single-phase earth fault can be detected and indicated locally by blinking LED. The fault information and load current value can also be transmitted to the SCADA system. A data concentrator unit (DCU) will be equipped for data transmission from DCU to SCADA system by 2G/3G/4G networks. The connection between the sensors and DCU is done by optical fiber.

DCU can support maximum six groups of indicators. Each group includes 1 DCU, 3 short-circuit sensors and 1 earth-fault sensor.



2 TECHNICAL SPECIFICATIONS

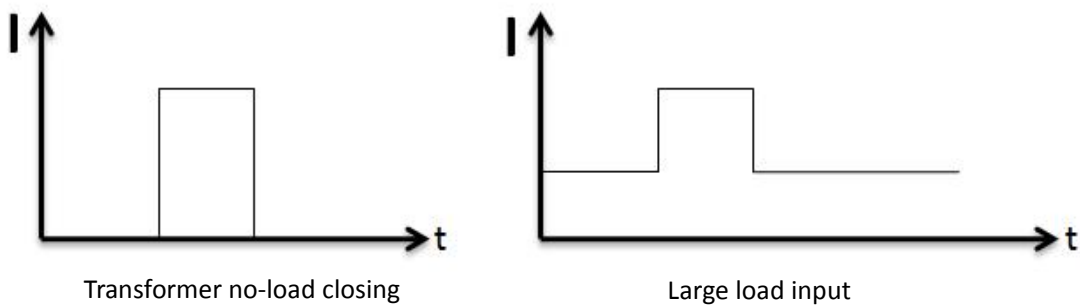
Parameter	Value
Short-circuit trip current (phase to phase)	adjustable, 1A step, 150A default
Earth-fault trip current (phase to ground)	adjustable: 1A step, 20A default
Earth-fault response delay	adjustable: 1 second step, 30s default
Indication unit reset	<ol style="list-style-type: none"> 1. remote reset by SCADA system 2. time reset: adjustable, 1 second step, 24h default 3. auto delay reset after repower, 1 second step, 30s default, only for permanent fault
Indicator Protection class	IP68
DCU Protection class	IP65
Internal type test	according to IEEEE495-2007
Operation temperature range	-40~+70°C
Altitude	<2000m
Relative humidity	5%~95%
Indicator battery	Lithium battery type AA 3.6V / 2700mAh
DCU Power Supply	12VDC
Battery life	approx. 10 years
Indicator Weight	approx. 600g
Power supply from line for indicator	When load current>10A
DCU Weight	< 5Kg
Current Accuracy	0A~300A: ±3A 300A~600A: ±1%
Cable diameter ranges for short circuit sensor	<40mm
Cable diameter ranges for earth fault sensor	<120mm
Blinking frequency	20 per minute, adjustable
Voltage range	5~38KV (if higher than 38KV, customized)
Max. load/fault current	1200A
Current withstand	31.5KA/4s
Communication medium	Indicator to DCU: Optical fiber DCU to SCADA: 2G/3G/4G
Communication Protocol	Indicator to DCU: Private DCU to SCADA: Modbus, IEC101, IEC104, DNP3.0

3 FUNCTION DESCRIPTION

3.1 False Triggering Prevention

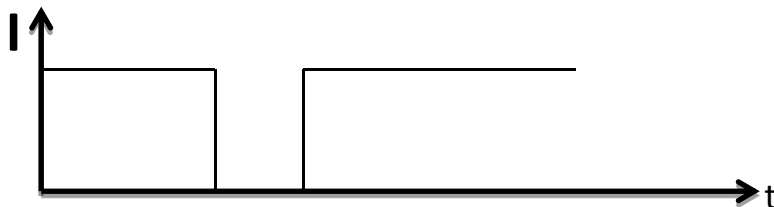
(a) Inrush current

Transformer of no-load closing and large load input will cause inrush current. Inrush current of power line is very high, regularly up to the fault current threshold, and the fault indicator can identify inrush current and ignore it.



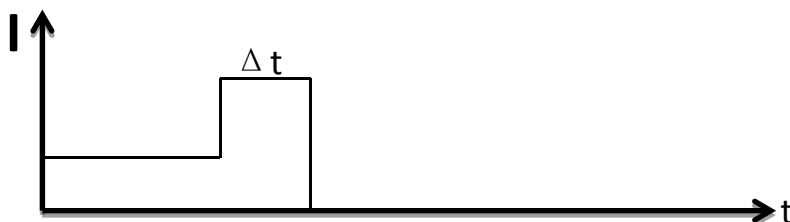
(b) Non-fault line reclosing

After fault occurs, the non-fault lines also have reclosing inrush current, and indicators can distinguish the feature.



(c) Heavy load input manually

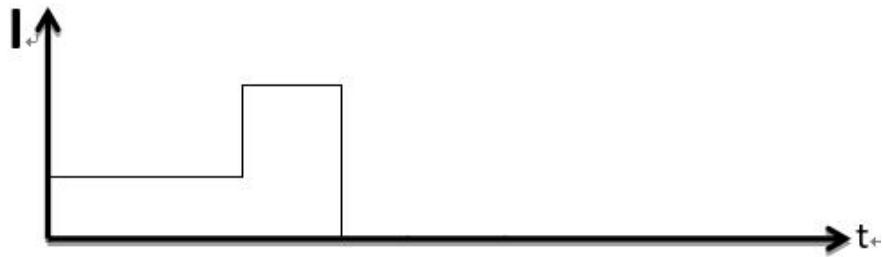
When there is heavy load on the line, the current will increase sharply. The line will lose power because of mechanism protection. The duration time of sharp current Δt is longer than the duration time of short circuit current. It can be modified based on actual situation. Indicators can distinguish the feature.



3.2 Short-circuit detection

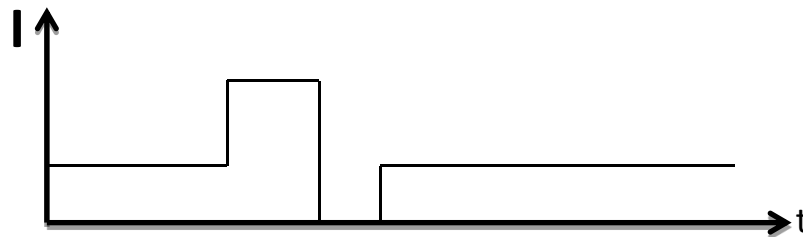
a) Permanent fault

The fault indicator can detect permanent short-circuit fault by electrical field and load current change features. No matter how many automatic reclosing are operated, it is identified as a permanent fault if there is outage.



b) Transient fault / temporary fault

If the fault is cleared after the automatic reclosing cycle and the line returns back to normal state, it is identified as a transient fault.



3.3 Earth-fault detection

The special zero sequence indicator is used for earth-fault detection. The earth-fault would be confirmed if the zero sequence current up to threshold and the duration exceeds the set value.

3.4 Load current upload

The indicator uploads current value to DCU and DCU uploads current value to SCADA within the configurable time (15 minutes by default), if the current value fluctuates with large amplitude, DCU will upload the value to SCADA immediately. The fixed time and the amplitude are adjustable.

3.5 Low battery alarm

The battery voltage can be measured every 20 milliseconds. The white mechanical flag will be flopped to yellow flag when battery voltage value is less than threshold value. The low battery alarm will be also transmitted to SCADA system to remind the operation and maintenance personnel to change the battery in indicators.

The default threshold value is 3.2V, which can be adjusted by tools.

3.6 Fault Local indication

The three ultra-bright red LEDs of indicator will blink when permanent fault, transient fault, or earth-fault are confirmed. Fault type can't be distinguished locally

3.7 Fault remote indication

The fault information would also be transmitted to SCADA system. You can find many useful information like fault type, load current value, battery value on SCADA system. Especially when fault occurs, the fault position would be located within a few minutes.

3.8 Fault reset

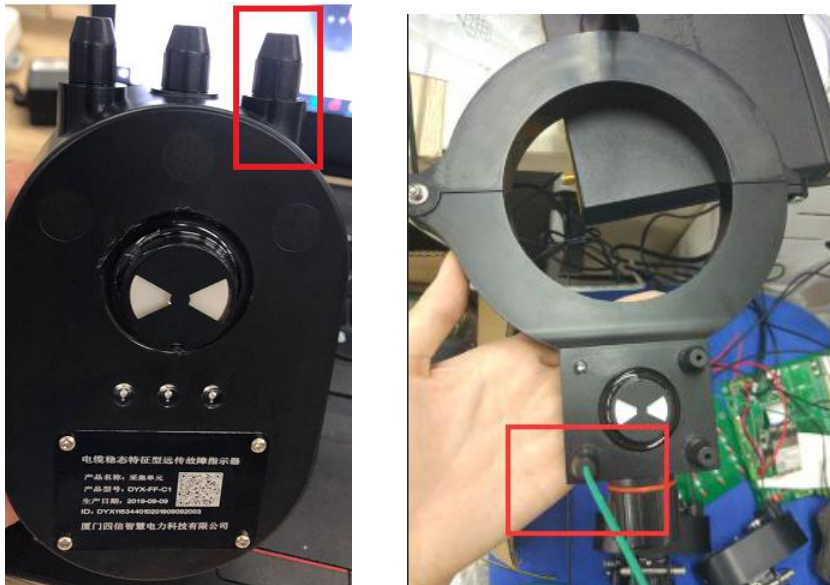
For permanent fault, the indicator will be reset after a configurable time (0~5minutes, 1s step) when the line is re-powered. And for transient fault and earth-fault type, the indicator will keep blinking for a configurable time (0~48 hours, 1s step). During the time of blinking, a new fault can be detected, and the reset time will be recalculated.

4. Parameters Setting Instruction

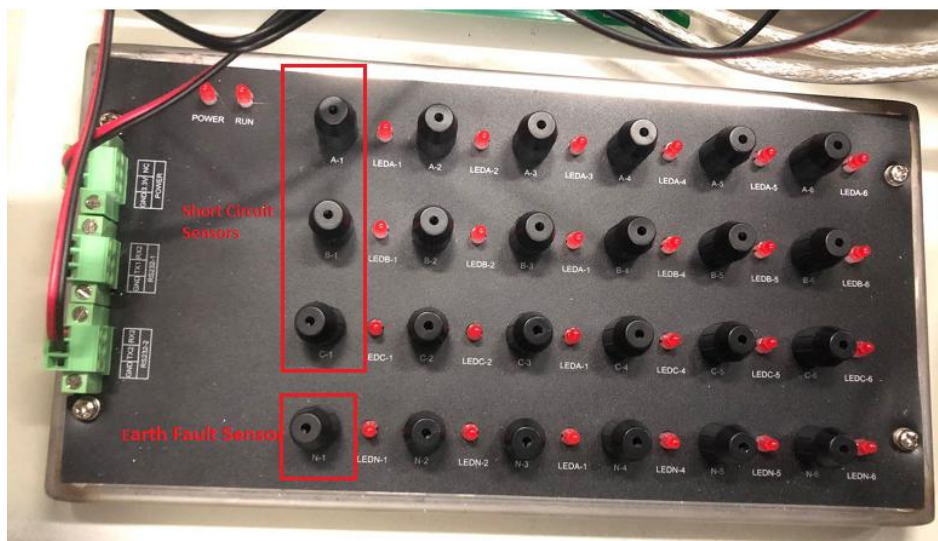
4.1 Cable Connection

Before configuration, it is necessary to do all connection as following:

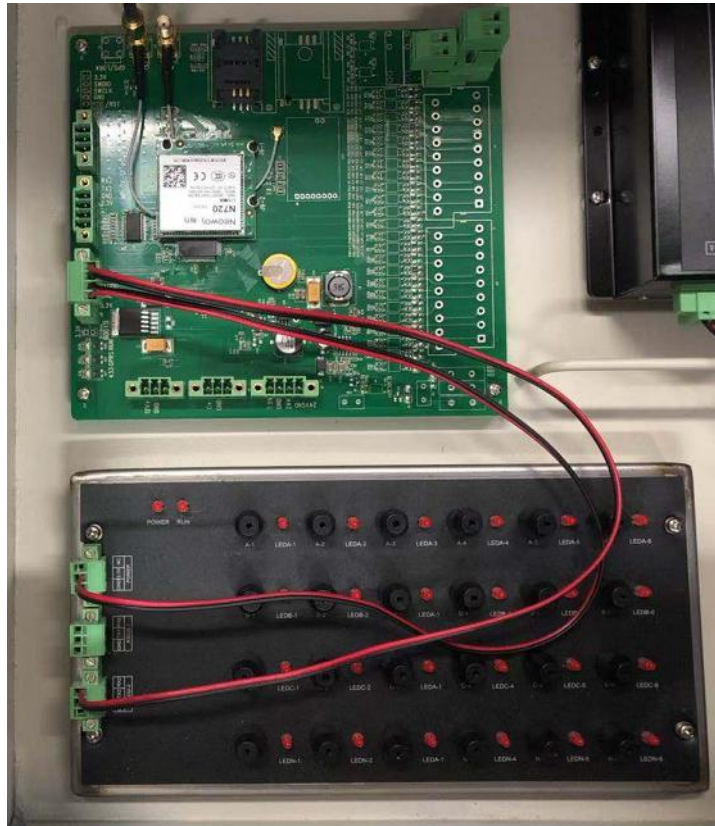
- a) Connect optical fiber to short circuit and earth fault sensors shown as below



- b) Connect optical fiber from short circuit/earth fault sensors to optical panel shown as below. One optical panel can maximum connect 6 groups of indicators.



- c) Connect cable between DCU and optical panel as shown in below picture. Normally it is already connected before delivery



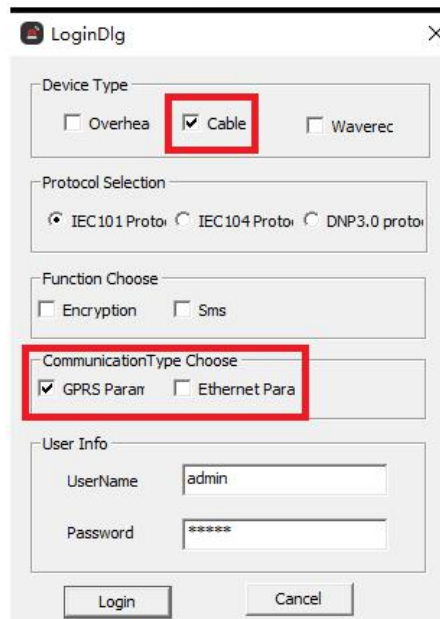
- d) Connect the power cable and serial cable for DCU board as shown in below picture. DCU will be supplied by 12VDC, and the COM port should be connected to PC



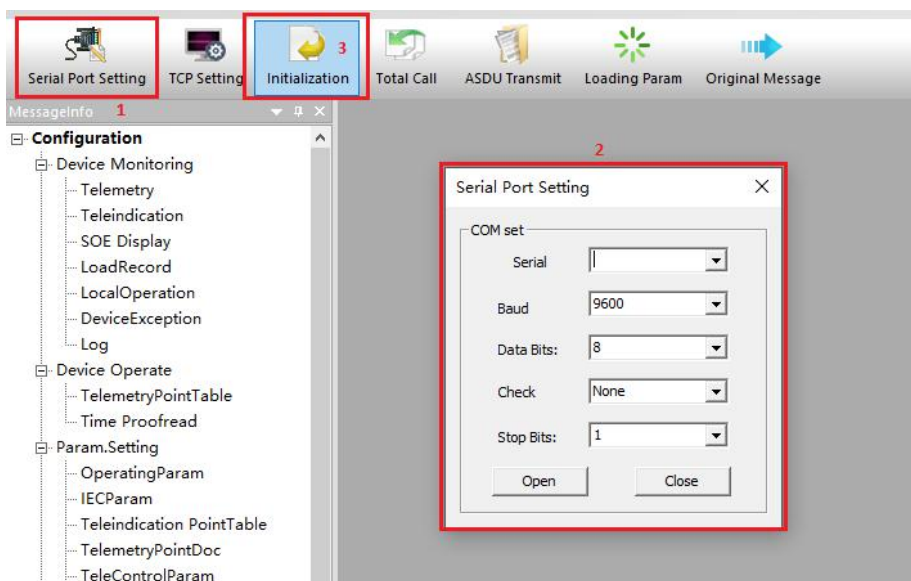
4.2 Configuration Tool

After cable connection, all settings can be configured through the software tool FaultIndicator.exe. **After you changed the value, you need to save it and restart DCU to make the change take effect.**

Open the “Faultindicator.exe” SW tool, tick “Cable” as shown in below figure



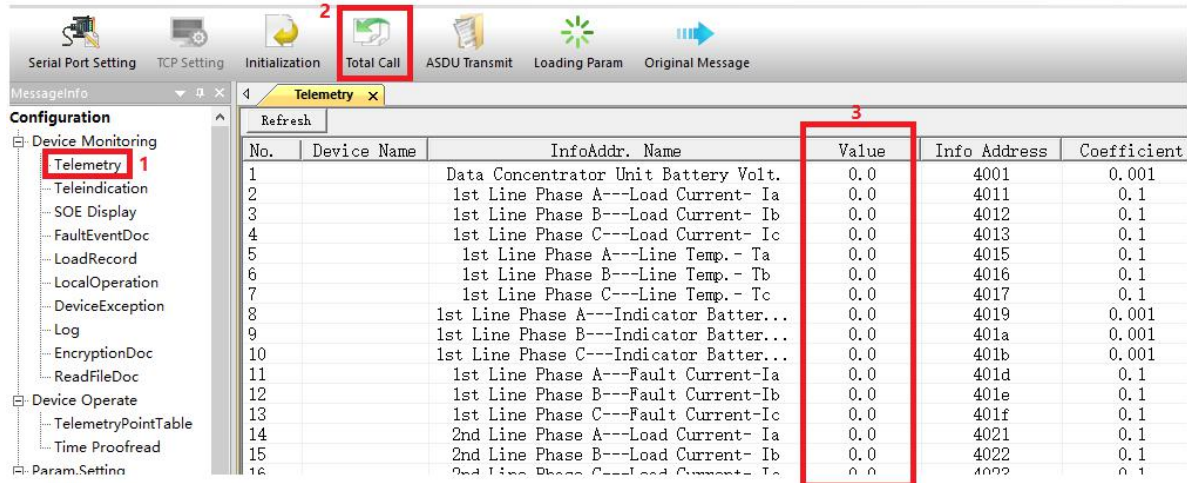
Click “Serial Port Setting”, fill in the serial port and baudrate, click “open”, the connection is set up, Then you can click “initialization” on the top menu to test the link, if there is no returned error information, that means the communication between DCU and PC is normal.



4.3 DCU Parameters Setting

4.3.1 Telemetry Parameters

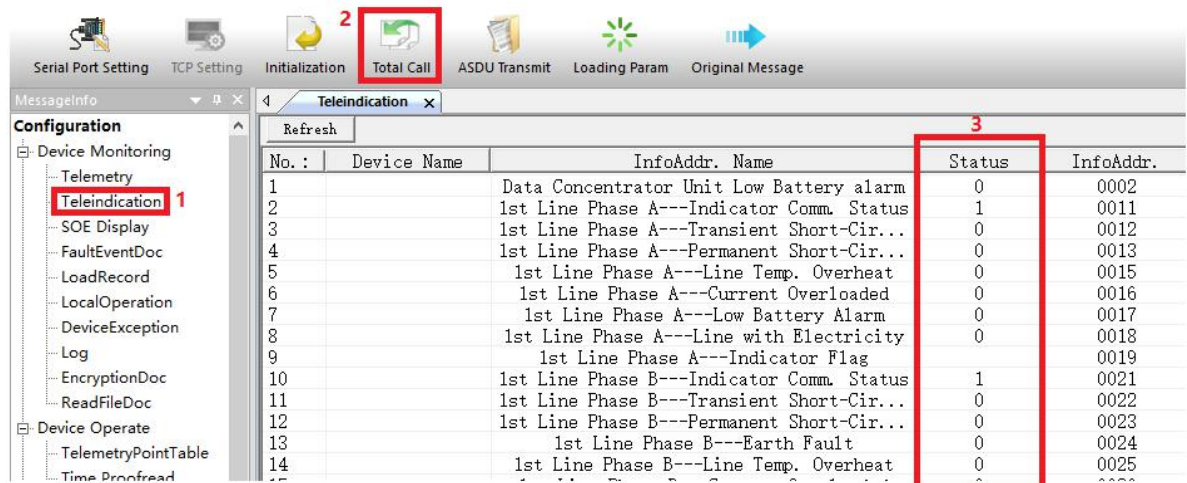
Double click “Telemetry”, then click “Total Call”, you will see the value of telemetry.



No.	Device Name	InfoAddr. Name	Value	Info Address	Coefficient
1		Data Concentrator Unit Battery Volt.	0.0	4001	0.001
2		1st Line Phase A---Load Current- Ia	0.0	4011	0.1
3		1st Line Phase B---Load Current- Ib	0.0	4012	0.1
4		1st Line Phase C---Load Current- Ic	0.0	4013	0.1
5		1st Line Phase A---Line Temp. - Ta	0.0	4015	0.1
6		1st Line Phase B---Line Temp. - Tb	0.0	4016	0.1
7		1st Line Phase C---Line Temp. - Tc	0.0	4017	0.1
8		1st Line Phase A---Indicator Batter...	0.0	4019	0.001
9		1st Line Phase B---Indicator Batter...	0.0	401a	0.001
10		1st Line Phase C---Indicator Batter...	0.0	401b	0.001
11		1st Line Phase A---Fault Current-Ia	0.0	401d	0.1
12		1st Line Phase B---Fault Current-Ib	0.0	401e	0.1
13		1st Line Phase C---Fault Current-Ic	0.0	401f	0.1
14		2nd Line Phase A---Load Current- Ia	0.0	4021	0.1
15		2nd Line Phase B---Load Current- Ib	0.0	4022	0.1
16		2nd Line Phase C---Load Current- Ic	0.0	4023	0.1

4.3.2 Teleindication Parameters

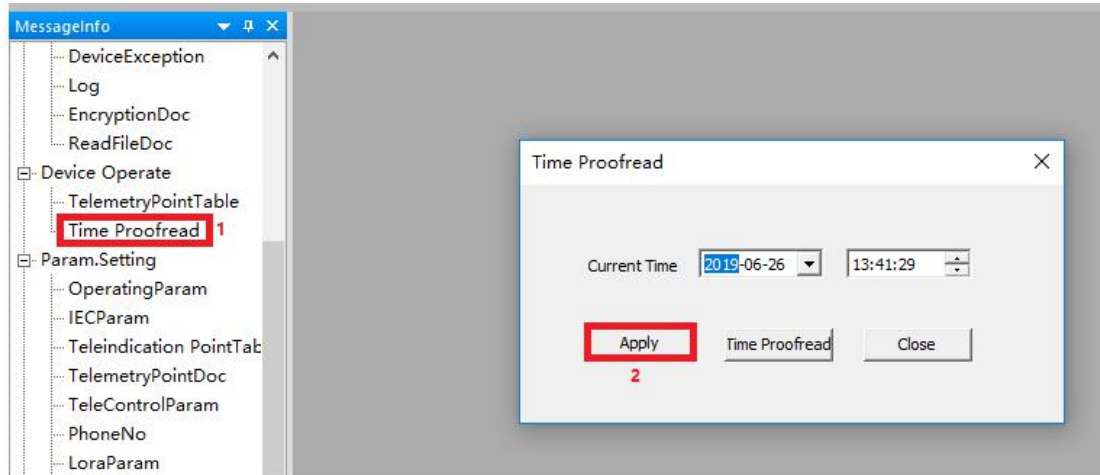
Double click “Teleindication”, then click “Total Call”, you will see the value of teleindication.



No. :	Device Name	InfoAddr. Name	Status	InfoAddr.
1		Data Concentrator Unit Low Battery alarm	0	0002
2		1st Line Phase A---Indicator Comm. Status	1	0011
3		1st Line Phase A---Transient Short-Cir...	0	0012
4		1st Line Phase A---Permanent Short-Cir...	0	0013
5		1st Line Phase A---Line Temp. Overheat	0	0015
6		1st Line Phase A---Current Overloaded	0	0016
7		1st Line Phase A---Low Battery Alarm	0	0017
8		1st Line Phase A---Line with Electricity	0	0018
9		1st Line Phase A---Indicator Flag	0	0019
10		1st Line Phase B---Indicator Comm. Status	1	0021
11		1st Line Phase B---Transient Short-Cir...	0	0022
12		1st Line Phase B---Permanent Short-Cir...	0	0023
13		1st Line Phase B---Earth Fault	0	0024
14		1st Line Phase B---Line Temp. Overheat	0	0025

4.3.3 Time Calibration

Double click “Time Proofread”, you will see the window shown as below

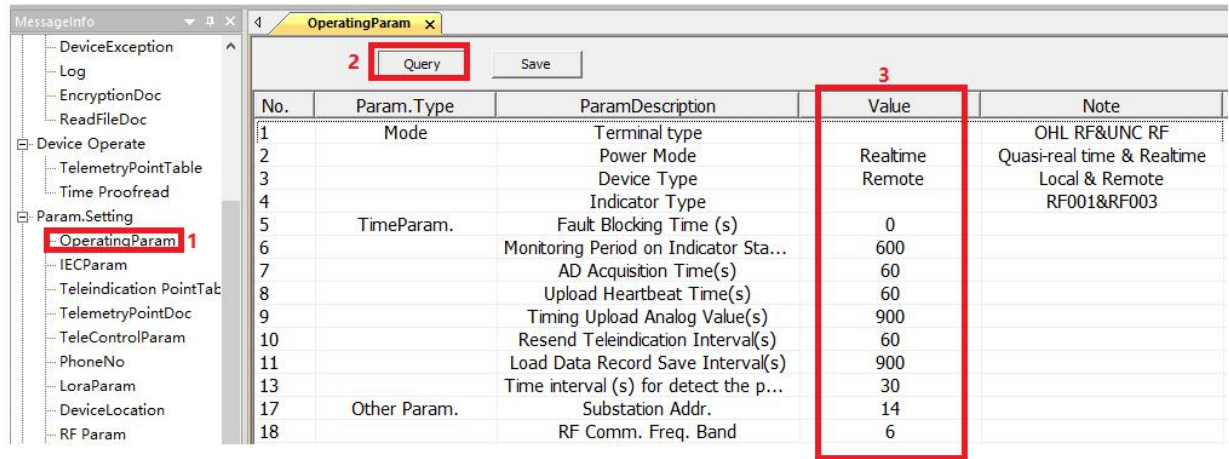


◆ **Apply:** Apply time proofread, you can calibrate the time.

◆ **Time Proofread:** You can read the time information from DCU

4.3.4 Operational Parameters

Double click “OperatingParam”, then click “Query”, you will see the value



No.	Param.Type	ParamDescription	Value	Note
1	Mode	Terminal type		OHL RF&UNC RF
2		Power Mode	Realtime	Quasi-real time & Realtime
3		Device Type	Remote	Local & Remote
4	TimeParam.	Indicator Type		RF001&RF003
5		Fault Blocking Time (s)	0	
6		Monitoring Period on Indicator Sta...	600	
7		AD Acquisition Time(s)	60	
8		Upload Heartbeat Time(s)	60	
9		Timing Upload Analog Value(s)	900	
10		Resend Teleindication Interval(s)	60	
11		Load Data Record Save Interval(s)	900	
13		Time interval (s) for detect the p...	30	
17	Other Param.	Substation Addr.	14	
18		RF Comm. Freq. Band	6	

◆ Mode Selection

Terminal Type: include overhead RF and underground cable lines RF

Power mode: Real time and quasi-real time. When set to quasi-real time, device doesn't deal with network tasks.

Device Type: Local fault indicator or remote fault indicator

Indicator Type: not used

◆ Time Parameter

Fault blocking time(S) : When the fault occurs to the indicator, it will be reported. When the time is out, the fault information will be cleared in DCU.

Monitoring Period on Indicator Status(S): the communication period between indicator and Concentrator Unit. When the time is out it will report the status of the indicator.

AD acquisition Time(S): Interval time of solar panel voltage & battery voltage acquisition

Upload heartbeat time(S): heartbeat interval time

Timing upload analog value: Period of telemetry upload time

Resend Teleindication interval(S): when SOE timeout, retransmission time

Load Data Record Save Interval: Period of save time for load

◆ **Other Parameters**

Substation Addr.: ASDU/Link address of 101 communication protocol

RF Comm. Freq. Band: RF 433 communication Frequency.

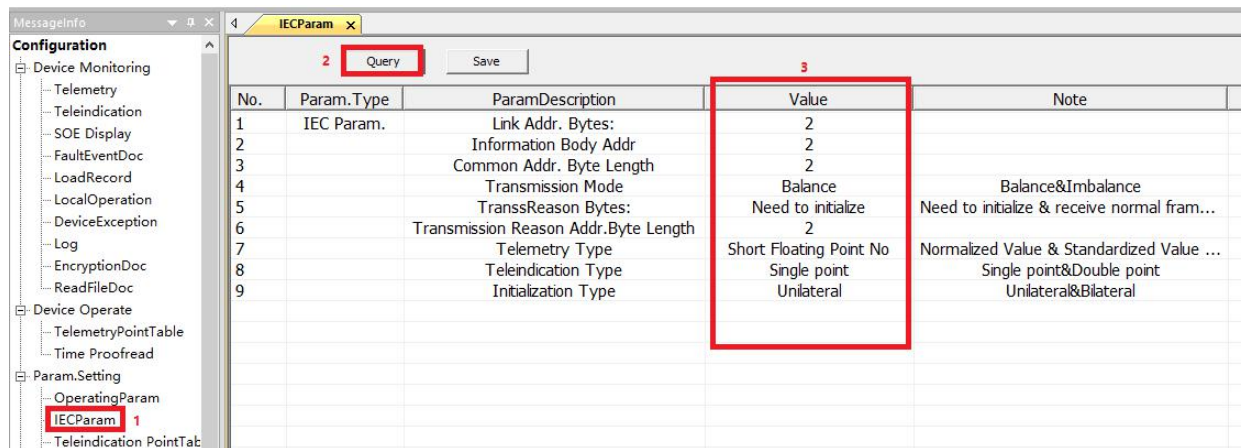
Absolute Threshold of Telemetry, Relative Threshold of Telemetry: when the telemetry reaches these two conditions, will upload the telemetry to the server station.

Absolute Threshold of Temp.: not used.

4.3.5 IEC Settings

For different customers’ requirements, the user can set the specifications of 101 protocol. After the setting, user needs to restart terminal for the setting to take effect. Specific settings are as follows:

Double click “IECParam”, then click “Query”, you will see the value of parameters:



No.	Param.Type	ParamDescription	Value	Note
1	IEC Param.	Link Addr. Bytes:	2	
2		Information Body Addr	2	
3		Common Addr. Byte Length	2	
4		Transmission Mode	Balance	Balance&Imbalance
5		TranssReason Bytes:	Need to initialize	Need to initialize & receive normal fram...
6		Transmission Reason Addr.Byte Length	2	
7		Telemetry Type	Short Floating Point No	Normalized Value & Standardized Value ...
8		Teleindication Type	Single point	Single point&Double point
9		Initialization Type	Unilateral	Unilateral&Bilateral

◆ Parameters “Link Addr. Bytes”, “Information Body Addr”, “Common Addr. Byte Length” and “Transmission Reason Addr. Byte Length” mean the length of corresponding value

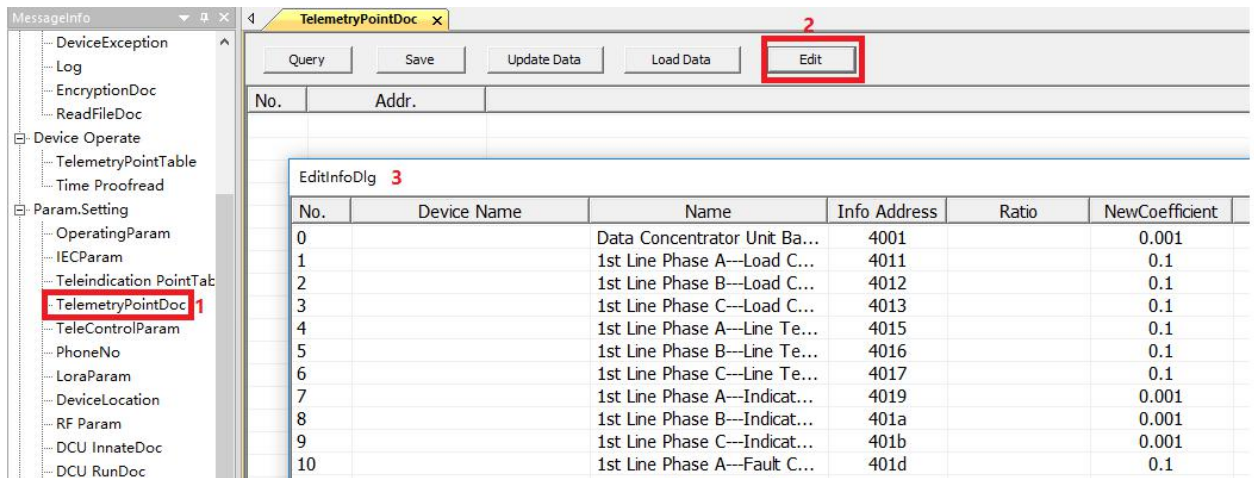
◆ **Transmission Mode:** equilibrium mode or non-equilibrium mode of 101 protocol.

◆ **Telemetry Type:** data type of telemetry

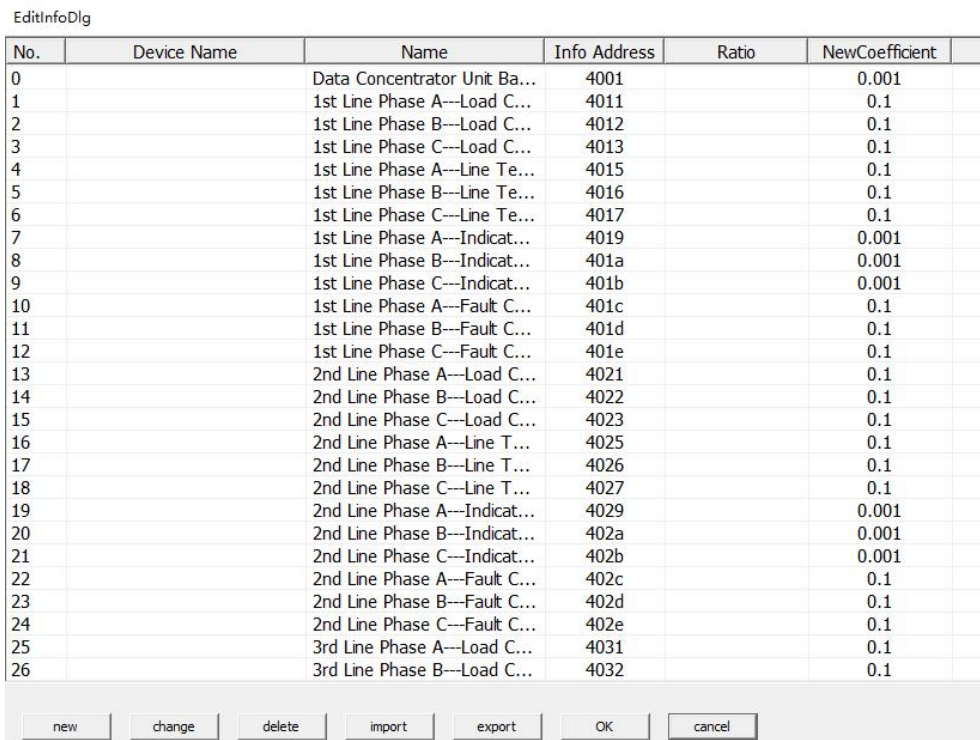
◆ **Teleindication Type:** data type of teleindication

◆ **Initialization Type:** you can choose if only DCU is initialized or both DCU and main station are initialized

4.3.6 Telemetry Point List

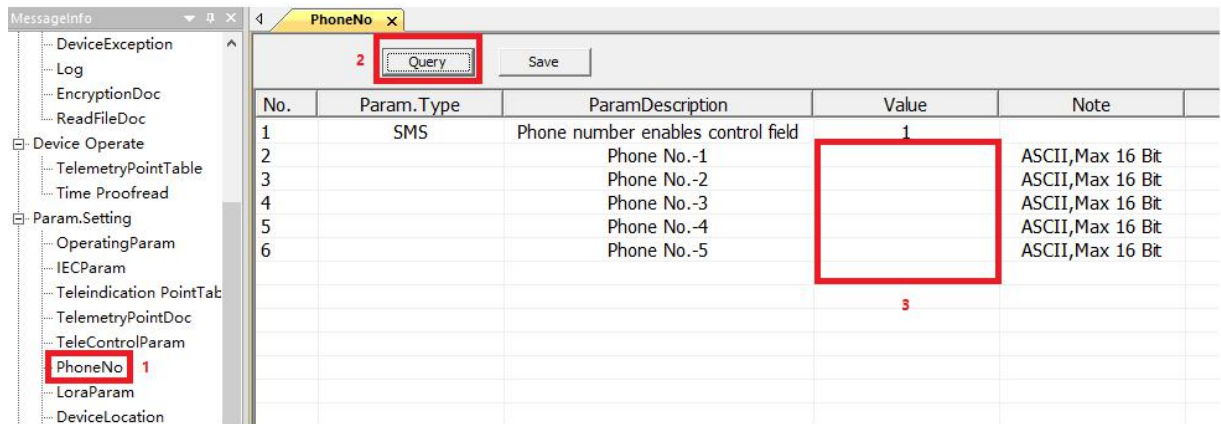


Double click “TelemetryPointDoc”, then click “Edit”, you will see interface window as below. You can check, add and modify Name and Info Address of the under-surveillance object.

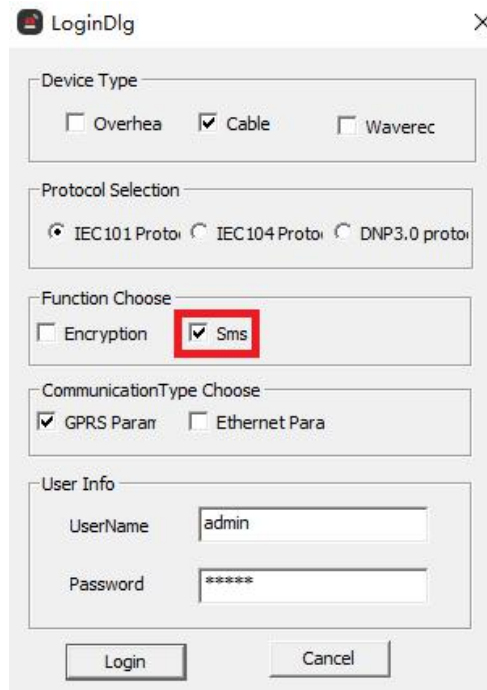


The Operation of “Teleindication PointTable” is the same.

4.3.7 Phone Numbers Settings



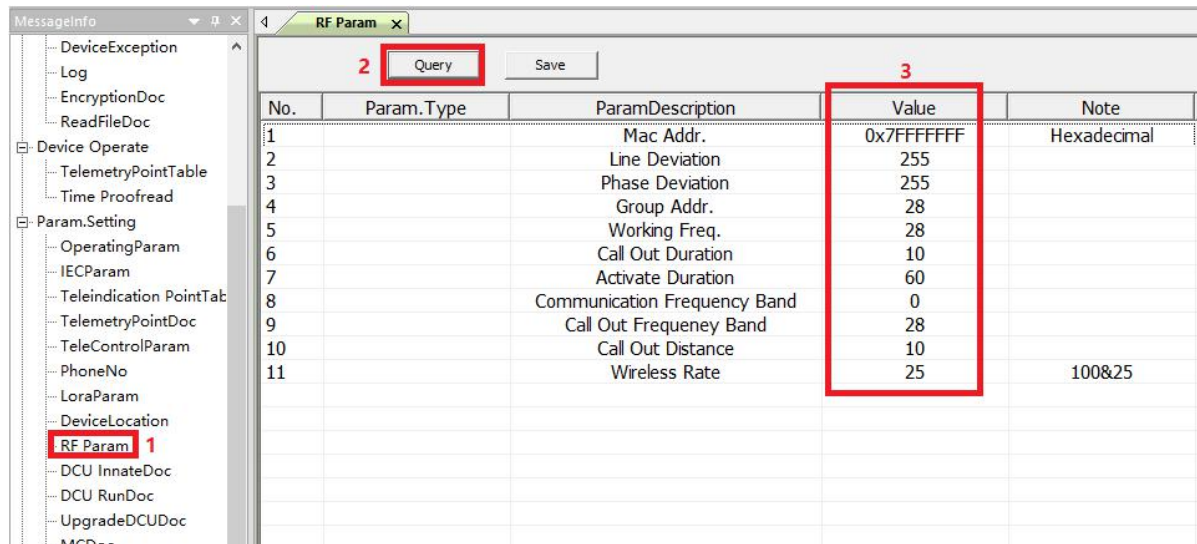
- ◆ Phone numbers activation setting: in the login window of SW tool “FaultIndicator.exe”, you need to tick “Sms”



- ◆ Phone Numbers: Enter the correct phone number and save.

4.3.8 RF Parameter

Double click “RF Param”, then click “Query”, you will see the value of parameters

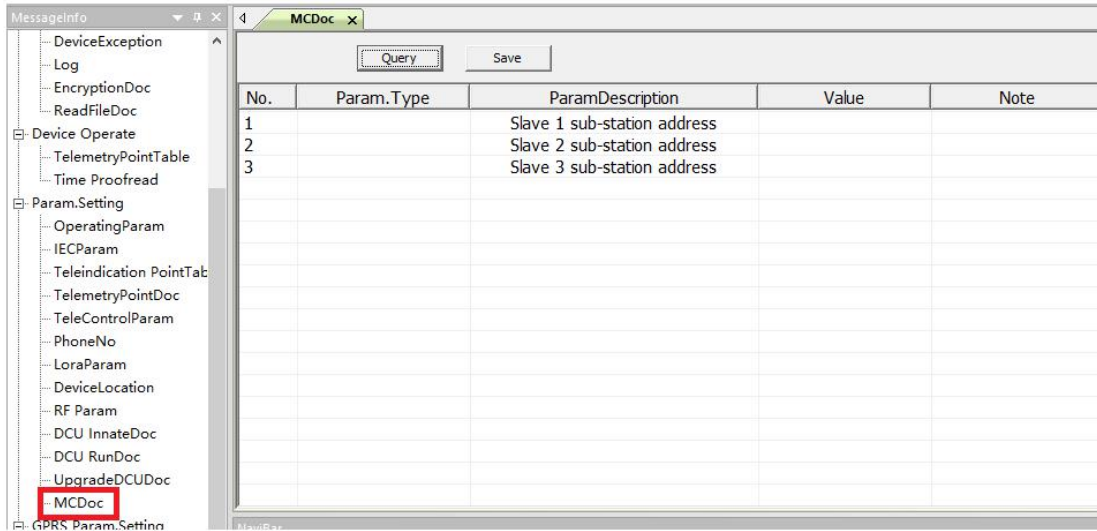


No.	Param.Type	ParamDescription	Value	Note
1		Mac Addr.	0x7FFFFFFF	Hexadecimal
2		Line Deviation	255	
3		Phase Deviation	255	
4		Group Addr.	28	
5		Working Freq.	28	
6		Call Out Duration	10	
7		Activate Duration	60	
8		Communication Frequency Band	0	
9		Call Out Frequency Band	28	
10		Call Out Distance	10	
11		Wireless Rate	25	100&25

- ◆ **Group Addr. and Working Freq.:** these two values must be the same with DCU’s, they are used for matching between indicator and DCU.
- ◆ **Call out Duration:** the duration of call out
- ◆ **Activate Duration:** the duration time of DCU after it is woken up.
- ◆ **Communication Frequency Band:** communication frequency is 433MHz
- ◆ **Call out Frequency Band:** frequency band during calling out
- ◆ **Call Out Distance:** the distance between indicator and DCU during calling out
- ◆ **Wireless Rate:** the speed of communication between indicator and DCU

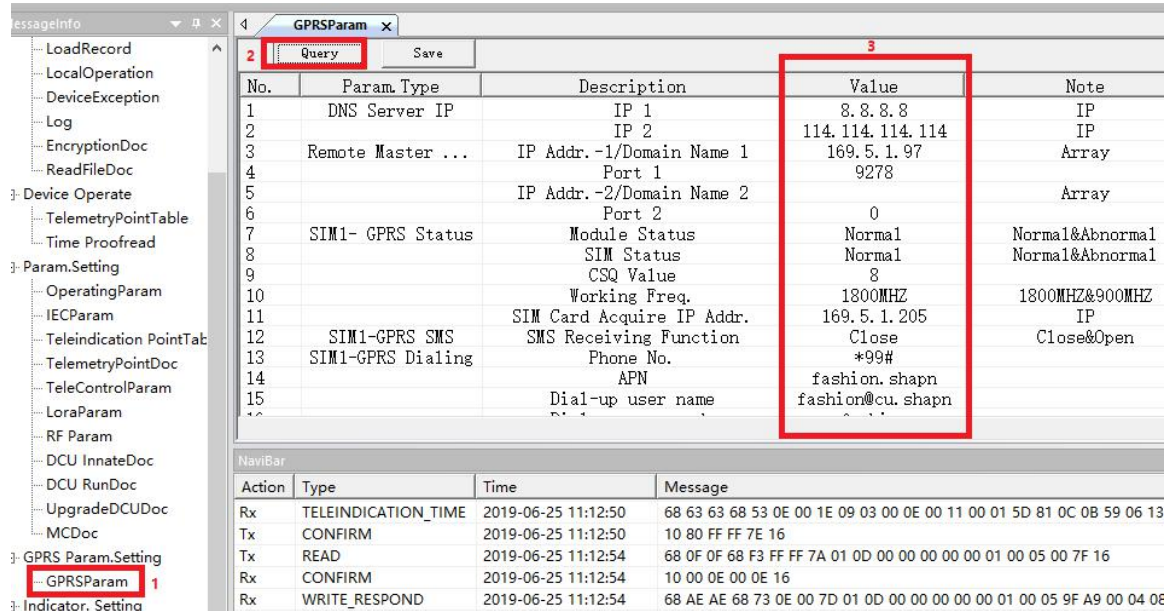
4.3.9 MC Parameter

If there are DCU substations that communicate with master DCU by Lora, you can add the address of sub-DCU here



4.3.10 GPRS Settings

Double click “GPRSPParam”, then click “Query”, you will see the value of GRPS parameters



No.	Param Type	Description	Value	Note
1	DNS Server IP	IP 1	8.8.8.8	IP
2		IP 2	114.114.114.114	IP
3	Remote Master ...	IP Addr. -1/Domain Name 1	169.5.1.97	Array
4		Port 1	9278	
5		IP Addr. -2/Domain Name 2		Array
6		Port 2	0	
7	SIM1- GPRS Status	Module Status	Normal	Normal&Abnormal
8		SIM Status	Normal	Normal&Abnormal
9		CSQ Value	8	
10		Working Freq.	1800MHZ	1800MHZ&900MHZ
11		SIM Card Acquire IP Addr.	169.5.1.205	IP
12	SIM1-GPRS SMS	SMS Receiving Function	Close	Close&Open
13	SIM1-GPRS Dialing	Phone No.	*99#	
14		APN	fashion.shapn	
15		Dial-up user name	fashion@cu.shapn	

◆ DNS server IP

It is used to set the DNS server IP. When the remote host uses domain name, the “value” must be fulfilled with the DNS server IP, e.g. 114.114.114.114.

Support 2 DNS server IP, different one corresponding to different SIM card

◆ Remote Master IP and Port

It is used to set the remote host (main station) IP and port

Support 2 remote host IP or Domain name, different one corresponding to different SIM card

◆ SIM1 GPRS Status

The GPRS status cannot be set. It is used to check the module conditions in the data concentrator, Module status, SIM card status, CSQ value, working frequency and the SIM card IP address are obtained by the card.

◆ SIM1 GPRS SMS

It is used to set the receiving of message, “close” means OFF, “open” means ON.

◆ SIM1 GPRS Dialing

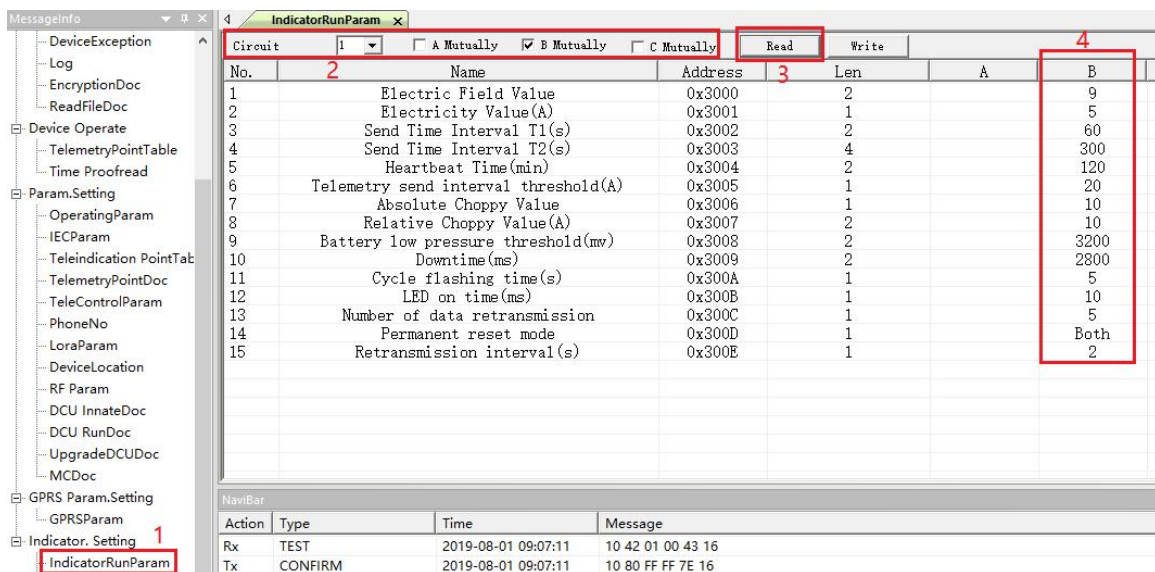
If SIM card is public network, just take the default value, otherwise you need to get information from SIM card supplier

4.4 Indicator parameters setting

The parameters of indicator can also be set in SW tool “FaultIndicator.exe”.

4.4.1 Running parameters

Double click “IndicatorRunParam”, then select the line and phase of indicator, click “read” button, you will see the result shown as below:



No.	Name	Address	Len	A	B
1	Electric Field Value	0x3000	2		9
2	Electricity Value(A)	0x3001	1		5
3	Send Time Interval T1(s)	0x3002	2		60
4	Send Time Interval T2(s)	0x3003	4		300
5	Heartbeat Time(min)	0x3004	2		120
6	Telemetry send interval threshold(A)	0x3005	1		20
7	Absolute Choppy Value	0x3006	1		10
8	Relative Choppy Value(A)	0x3007	2		10
9	Battery low pressure threshold(mv)	0x3008	2		3200
10	Downtime(ms)	0x3009	2		2800
11	Cycle flashing time(s)	0x300A	1		5
12	LED on time(ms)	0x300B	1		10
13	Number of data retransmission	0x300C	1		5
14	Permanent reset mode	0x300D	1		Both
15	Retransmission interval(s)	0x300E	1		2

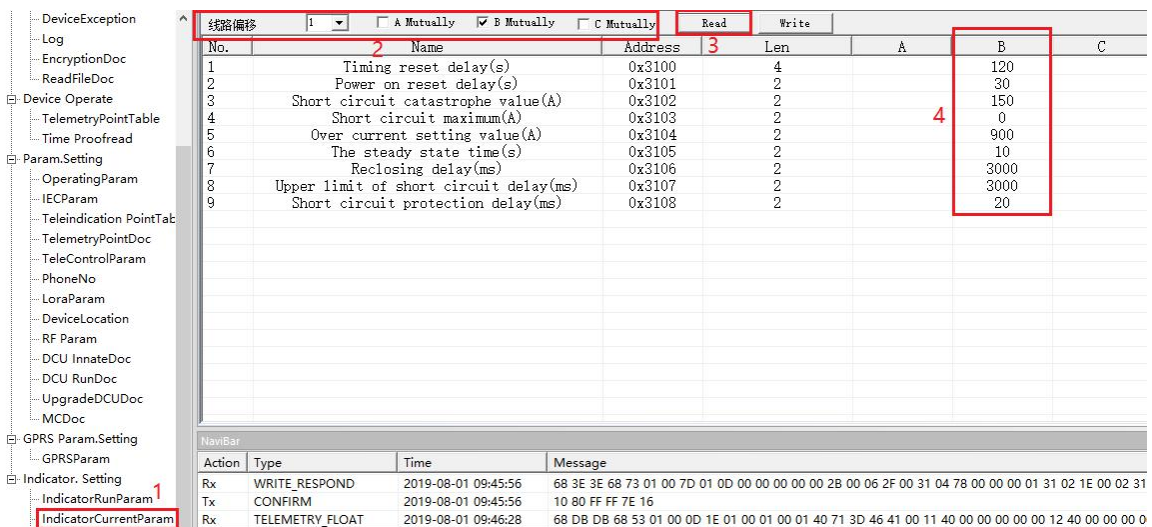
Action	Type	Time	Message
Rx	TEST	2019-08-01 09:07:11	10 42 01 00 43 16
Tx	CONFIRM	2019-08-01 09:07:11	10 80 FF FF 7E 16

- ◆ **Electric Field Value:** One of base that the line is powered or not. It will be adjusted according to insulated line and bare line
- ◆ **Electricity Value(A):** The other base that the line powered or not. It is related to short-circuit and earth-fault judgment and not recommended to modify, 5A default
- ◆ **Send Time Interval T1(s):** The load current upload period. When Load current value is greater than “Telemetry send interval threshold”, indicator uploads load current at this interval. 60 seconds default
- ◆ **Send Time Interval T2(s):** The load current upload period. When Load current value less than “Telemetry send interval threshold” and greater than “Electricity value”, indicator uploads load current at this interval. 300 seconds default.
- ◆ **Heartbeat Time(min):** The heartbeat period of outage. 120 minutes default.
- ◆ **Telemetry send interval threshold(A):** the current value to distinguish the interval of load current update, 20A default
- ◆ **Absolute Choppy Value(A):** The current absolute mutation value, 10A default

- ◆ **Relative Choppy Value:** The current relative mutation value, 10% default
- ◆ **Battery low pressure threshold(mv):** threshold value of low battery alarm, 3.2V default.
- ◆ **Downtime(ms):** load current measurement interval when there is no power in the line,
- ◆ **Cycle flashing time(s):** The period of blinking, 5 seconds default.
- ◆ **LED on time(ms):** The delay time of LED light up. 10 milliseconds default.
- ◆ **Number of data retransmission:** data re-transmitted times when communication failure. 5 default
- ◆ **Permanent reset mode:** The indicators reset model for permanent fault.
- ◆ **Retransmission interval(s):** Data re-transmitted period when communication failure. 2seconds default

4.4.2 Current Parameters

Double click “IndicatorCurrentParam”, then select the line and phase of indicator, click “read” button, you will see the result shown as below:



No.	Name	Address	Len	A	B	C
1	Timing reset delay(s)	0x3100	4		120	
2	Power on reset delay(s)	0x3101	2		30	
3	Short circuit catastrophe value(A)	0x3102	2		150	
4	Short circuit maximum(A)	0x3103	2		0	
5	Over current setting value(A)	0x3104	2		900	
6	The steady state time(s)	0x3105	2		10	
7	Reclosing delay(ms)	0x3106	2		3000	
8	Upper limit of short circuit delay(ms)	0x3107	2		3000	
9	Short circuit protection delay(ms)	0x3108	2		20	

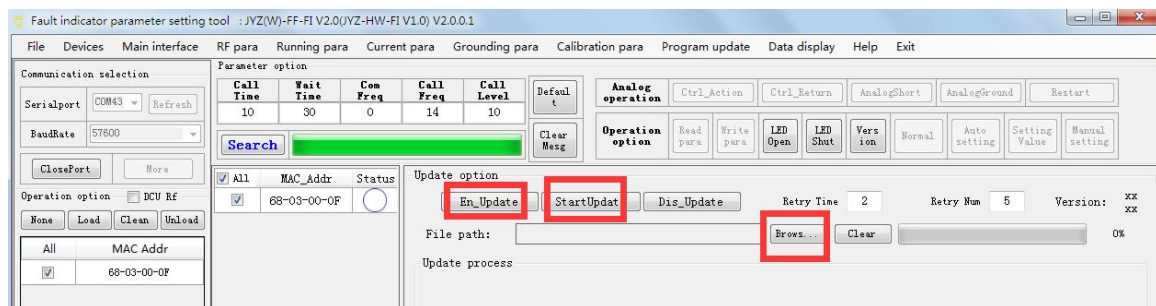
- ◆ **Timing reset delay(s):** The auto-reset delay time of permanent, transient and earth fault. 120 seconds default
- ◆ **Power on reset delay(s):** The auto-reset delay time of permanent fault after the line is repowered. 30 seconds default
- ◆ **Short circuit catastrophe value(A):** The minimum change value to judge short-circuit fault, 150A default. It can be adjusted according to the real situation.

- ◆ **Short circuit maximum(A):** not used
- ◆ **Over current setting value(A):** The threshold of over-current value, 900A default
- ◆ **The steady state time(s):** The line power and the indicator charge time. It is necessary for fault detection. 10 seconds default.
- ◆ **Reclosing delay(ms):** To distinguish permanent fault and transient fault. If the line is outage after the reclosing time, a permanent fault will be confirmed. Then otherwise, it is a transient fault. 3000 milliseconds default.
- ◆ **Upper limit of short circuit delay(ms):** The maximum time of short-circuit current sustains. 3000 milliseconds default.
- ◆ **Short circuit protection delay(ms):** The minimum time of short-circuit current sustains. 20 milliseconds default

5 Upgrading online

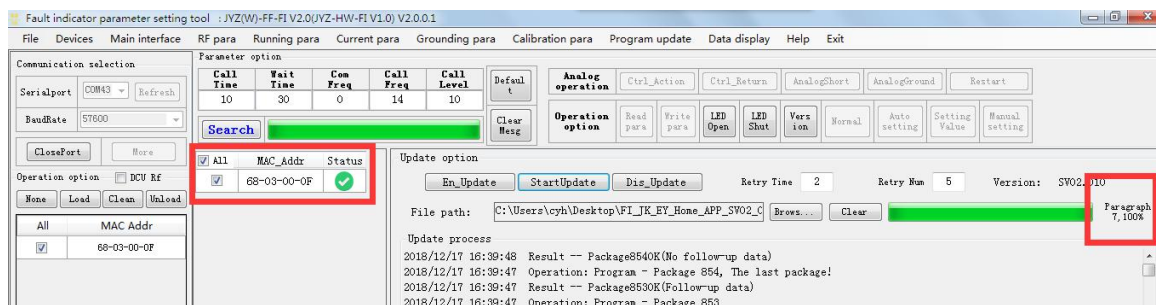
5.1 Indicator upgrading

The indicators can be updated online by wireless tool “Fault Indicator Parameter Setting Tool”. First of all, select the program file that will be wrote by “Browse file”. And then load the indicator which needs to be update. Click the button “En_Update” to enter into update state, the LED will blink continuously.



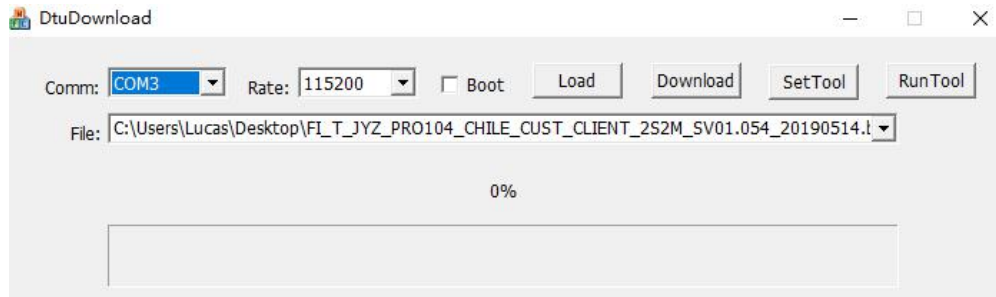
Before updating

At last, click “StartUpdate” button and wait until the progress bar reaches 100% and the status shows “OK”, and the update operation finished.

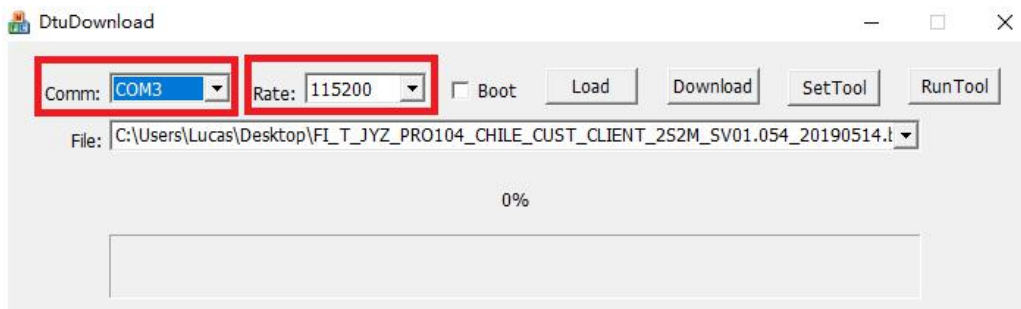


5.2 DCU Upgrading

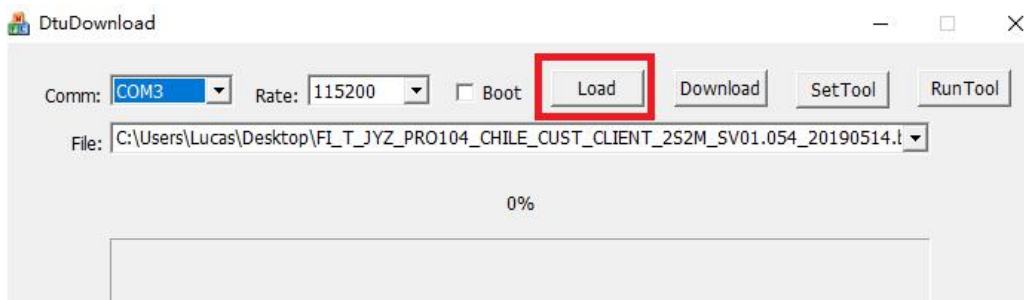
- 1) Disconnect the Power of DCU, connect RS232 connector and PC USB with cable
- 2) Run the SW tool “DtuDownload”



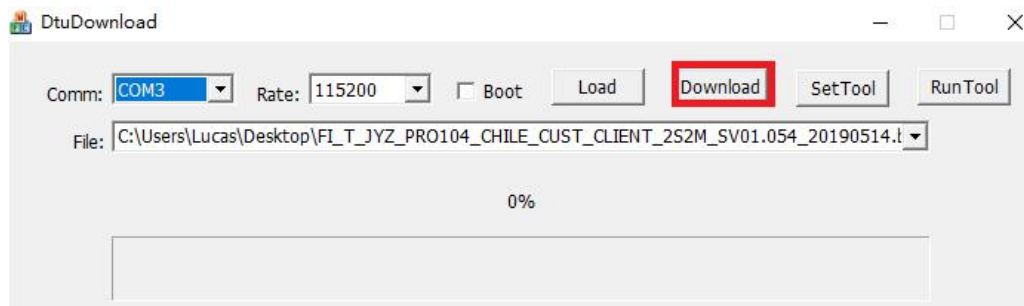
- 3) Select correct COM and Baudrate



- 4) Click “Load ” to select the firmware



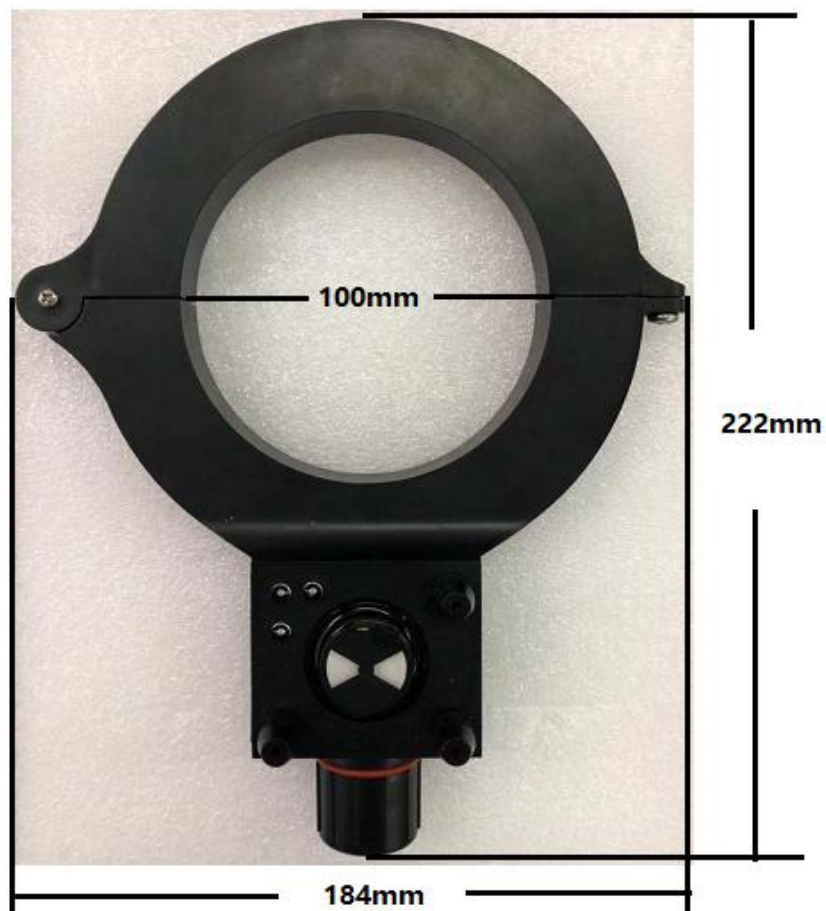
- 5) Click “Download” to download the SW from PC



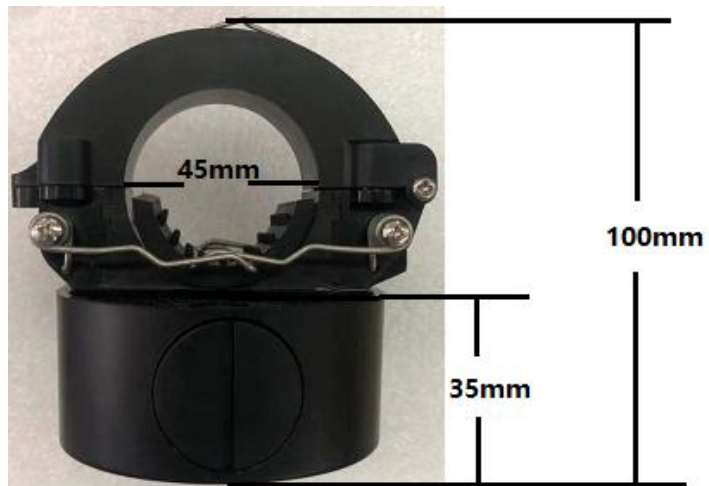
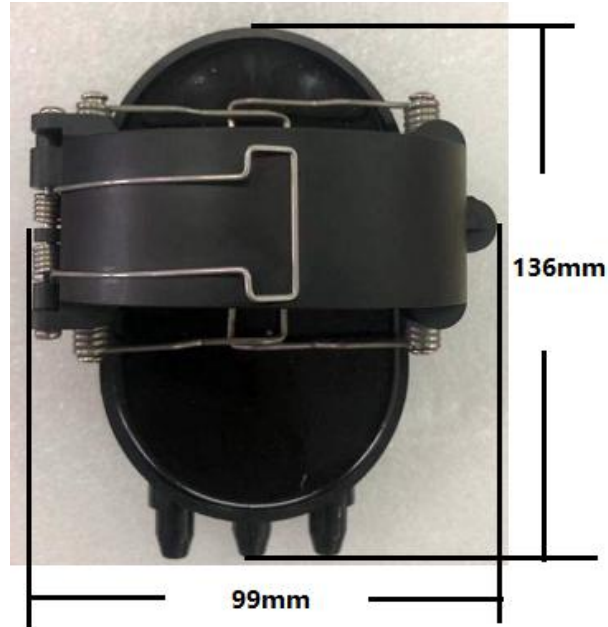
6) Connect the power of DCU. Then you could check the upgrade process run to 100%. That means the upgrade is successful.

6 Dimensions

6.1 Earth Fault Sensor



6.2 Short Circuit Sensor



7 Mounting instruction

Before installation in the field

Confirm the communication parameters configuration of indicators and DCU before the installation in the field, such as IP address, and port. And make sure the SIM card is in service and insert correctly.

Mounting

The indicators are mounted onto the Cable line. First of all, open the split coil CT with tools (picture a). Secondly install the indicator to the cable line (picture b)



Picture (a)



Picture (b)