



RS PRO SERIES SOFT STARTER RS 485 Communication Manual



RS Pro Part numbers

227-5224	227-5235	227-5227	227-5233
227-5226	227-5221	227-5229	227-5236
227-5219	227-5223	227-5230	227-5220
227-5231	227-5225	227-5232	227-5222

1、Parameters

1.1 General

The main starting / stopping parameters of RS PRO soft starter can be set by the front-panel potentiometers. Other parameters have been set up during factory commissioning, so users do not need to set them. Some parameters can be adjusted by RS485 communication.

Real-time data is also available over Modbus RTU, as well as operating parameters and event data such as number of starts and number of alarm events can be accessed.

1.1.1 Main parameter

Parameter	MODBUS address	Setting range	Default
Full Load Amps FLA	40002	1-100	Rated current of Soft Starter According to lectotype. Factory setting

1.1.2 Protection parameter

Parameter	MODBUS address	Setting range	Default
Over current protection value	40005	500-850%	500% Factory setting

Parameter	MODBUS address	Setting range	Default
Over current trip delay time	40006	0.1~1.0Sec.	0.1Sec. Factory setting



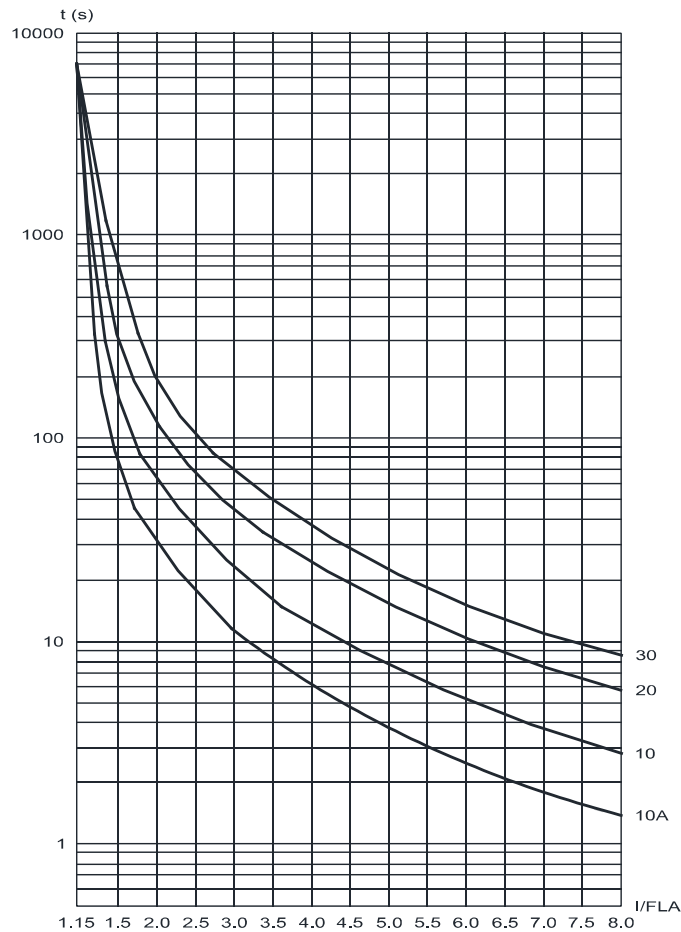
Caution

RS PRO has two different levels of over current breaking protection.

1. If the Soft Starter output current exceeds 850% of soft starter rated current (FLC), the soft starter will trip immediately. Fault relay (K2) tripped.
2. If the output current exceeds the over current protection set value (motor rated current FLA 200%-850%) the Fault Relay (K2) trip is delayed for a period of time. ("over current action delay time" specified time). If the delay time is exceeded the fault relay (K2) trips.

Parameter	MODBUS address	Setting range	Default
Over-load protection	40007	100~200%	110% Factory setting

Parameter	MODBUS address	Setting range	Default
Overload protection grade	40008	0-CLASS10A 1-CLASS 10 2-CLASS 20 3-CLASS 30	0-CLASS10A Factory setting



Overload curve



Note:

Thermal protection of RS PRO Soft Starters.


It is recommended that users set the overload protection to Class 10A,

Example. RS227-5221, FLA = 5.5A @ 400Vac. Overload value = FLA x 1.10 (factory default).
 $5.5 \times 1.10 = 6.05A$

At currents exceeding 6.05A the Soft Starter will measure time and trip according to the tripping class curve. In this example the tripping time at Class 10A will be approximately 2.5 seconds @ 6.05A static current. At Tripping Class 10 the trip time will be approximately 5 seconds. Therefore, the user can see how the tripping class setting will affect Soft Start over-current protection. The longer time the Soft Starter is over-current the hotter it will get. This can reduce its working life.


Parameter	MODBUS address	Setting range	Default
Phase sequence protection	40015	0- OFF 1- ON	1-ON

The parameter setting protection functions not introduced above.


	<p>Note: Additional protection features of RS PRO Soft Starters:</p> <ol style="list-style-type: none"> 1) Over-temperature protection. When the heatsink temperature $>85^{\circ}\text{C}$, the soft start trips. 2) When a soft starter input/output phase has failed the soft start trips. 3) When The phase sequence of the soft starter supply is abnormal motor start is inhibited. 4) When the power module is short circuited, soft start tripped. 5) If the three-phase current of the soft starter is unbalanced (three-phase current difference $> 20\% \text{FLA}$), the soft starter will trip.
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1.1.3 Start / stop parameters

Parameter	MODBUS address	Setting range	
Initial voltage	40010	30-70%	According to customer. Panel potentiometer setting.

	<p>Caution</p> <p>The Initial voltage is set using the potentiometer on the front panel and the set value can only be read through communication mode, but it can't be changed.</p>
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Parameter	MODBUS address	Setting range	Default
Starting time	40011	1-30 Sec.	According to customer. Panel potentiometer setting.

	<p>Caution</p> <p>The starting time is set using the potentiometer on the front panel and the set value can only be read through communication mode, but it can't be changed.</p>
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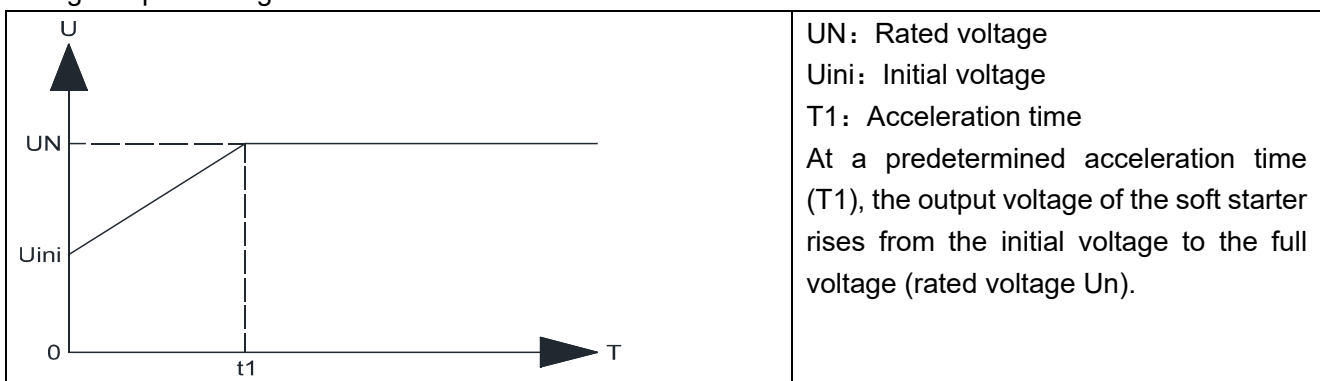
Parameter	MODBUS address	Setting range	Default
Stop time	40012	0-30 Sec.	According to customer. Panel potentiometer setting.



Caution

The stop time is set using the potentiometer on the front panel and the set value can only be read through communication mode, but it can't be changed.

Voltage slope starting mode



Caution

The motor can't start (Locked-Rotor) if the initial voltage is too low. It is suggested that initial voltage is adjusted from high to low or use the Recommended setting.

1.1.4 Relay parameters

Parameter	MODBUS address	Setting range	Default
Bypass relay type	40014	0- Continuous voltage output for Bypass Contactor coil 1- Momentary voltage output for Bypass Contactor with self-latching circuit	Depending on the specific model Factory setting



Caution
The bypass relay setting is determined at the factory depending on Soft Starter size and must not be changed.

1.1.5 Communication parameters

Parameter	MODBUS address	Setting range	Default
Slave machines address	40017	1~127	1 Factory setting

Parameter	MODBUS address	Setting range	Default
Baud rate	40018	0-1200BPS 1-2400BPS 2-4800BPS 3-9600BPS 4-19200BPS	3-9600BPS Factory setting

Parameter	MODBUS address	Setting range	Default
Parity check	40019	0-EVEN 1-ODD 2-NONE	0-ECC



Caution
After setting up the communication parameters the soft starter must be restarted.
Incorrect settings can cause communicate fault and could inhibit setting again.
RS PRO Soft Starters cannot be restored the default parameters, so please be careful when setting communication parameters.

1.2 Parameters table

Parameter	MODBUS address	Setting range	Factory setting
Full Load Amps(FLA)	40002	1...100A	According to product
Reserve	40003	0...1	0
Reserve	40004	65535...65535	
Over current protection value	40005	500%-850% FLA	500% FLA
Over current trip delay time	40006	0.1 ... 1SEC	0.1 Sec.
Over-load protection	40007	100-200% FLA	110% FLA
Overload protection grade	40008	0-CLASS10A 1-CLASS 10 2-CLASS 20 3-CLASS 30	0-grade10A
Reserve	40009		
Initial voltage	40010	0...15 ($n*3+30$)%	potentiometer setting.
Starting time	40011	0...15 $T_{start}=n*2$ (if $n=0$ $T_{start}=1SEC$)	potentiometer setting.
Stop time	40012	0...15 $T_{stop}= n*2$	potentiometer setting.
Parameter Setting	40013	0-potentiometer setting. 1-communication setting.	According to product
Bypass relay type	40014	0-Electric self holding relay 1-Magnet self holding relay	According to product
Phase sequence protection	40015	0- OFF 1- ON	
Bypass mode	40016	0-Send pulse after bypass 1-Stop pulse after bypass	
Slave machines address	40017	0-127	1
Baud rate	40018	0-1200BPS 1-2400BPS 2-4800BPS 3-9600BPS 4-19200BPS	3-9600BPS
Parity check	40019	0-EVEN 1-ODD 2-NONE	0-ECC

2、Communication

RS PRO Soft Starters feature RS-485 line.

2.1 RS-485 technical characteristics:

Asynchronous serial communication

Half duplex

Communication protocol: Modbus RTU

2.1.1 Baud rate

RS PRO supports 1200/2400/4800/9600/19200 BPS.

More detail: 1.1.5 Communication parameters.

2.1.2 Data bit

The data bit of RS PRO is 8.

2.1.3 Parity bit

Parity bit can be set: None/ECC/ODD.

More detail: 1.1.5 Communication parameters.

2.1.4 Stop bit

When Parity bit is none, Stop bit is 2;

When Parity bit is ECC or ODD, Stop bit is 1.

2.2 Response time

Normal response: 4mSec. \leq response time \leq 40mSec.

Long response: response time \leq 200mSec.

Notes:

Frequent queries will cause longer response time;

When setting the parameter by communication the interval time of a query should be 1000mSec.

RS PRO Soft Starters do not support broadcast communication.

When the Soft Starter is the communication bus terminal 120 Ω terminal resistance is recommended.

When the Soft Starter peer-to-peer communicates with a PC, terminal resistance is not required.

The maximum number of Soft Starter in a network is 32 depending of cable length and Modus power

The transmission distance should be <1.5KM (a relay is required if distance>1.5KM).

2.3 MODBUS Message RTU Framing

Start	Slave Address 1Byte	Function Code 1Byte	Data 1	Data n	CRC-Hi 1Byte	CRC-Lo 1Byte	Stop
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Start: Separated by a silent interval of at least 3.5 character times.

Slave Address: Slave Address from 1 to 127.

Function Code: Function Code (RS PRO Soft Starters support function Code 1, 2, 3, 4, 5, 6, 8, 15, 16)

Data 1...Data n: Data transmitted.

CRC-Hi: The CRC high - order byte from slave address to Data n.

CRC-Lo: The CRC low - order byte from slave address to Data n.

Stop: Separated by a silent interval of at least 3.5 character times.

2.3.1 Interval time

In RTU mode, message frames are separated by a silent interval of at least 3.5 character times. In the following sections, this time interval is called t_{3,5}.

$$\text{Interval time} = \frac{3.5 \times 11}{\text{BaudRate}} (\text{Sec.})$$

Example:

When Baud rate is 9600BPS, the interval time = $3.5 \times 11 / 9600 = 4\text{mSec}$. So the interval time $\geq 4\text{mSec}$.

2.3.2 Slave Address

The number of slaves can be set from 1 to 127. (The default number is 1)

2.3.3 Function Code

Function Code	Modbus instruction	RS PRO function
01	read Coil Status	read instruction Status
02	read Input Status	read Input/output Status
03	read holding registers	read RS PRO parameter setting
04	read analog input registers	read RS PRO real-time data
05	force single coil	force instruction Status
06	preset single register	preset single RS PRO parameter
08	diagnostic	check communication loop
15 (0x0F)	force multiple coils	force multiple instruction Status
16 (0x10)	preset multiple registers	preset multiple RS PRO parameter

2.3.4 Register

RS PRO Soft Starter	Register address (4Digital)	Number of registers	Permission
Instruction	00001...00008	8	R/W
Input/output Status	10001...10008	8	R
real-time data	30001...30016	16	R
parameter setting	40001...40032	32	R/W

2.4 Instruction (00001...00008 coil)

RS PRO Soft Starters have 8 coils

Address	RS PRO operation	illustration
00001	Start/Stop	=0 Stop, =1 Start *1
00002	Reserve	
00003	Reserve	
00004	Reserve	
00005	Reserve	
00006	Reserve	
00007	Reserve	
00008	Reset Fault	=0 NONE, =1 reset fault When this coil is set to 1, the Soft Starter will reset the fault if it is in the fault state. After reset fault, this coil will be set 0. IMPORTANT!! SEE *2 BELOW

*1: When starting the Soft Starter by communication (00001 is set 1), it can be stopped by communication (00001 is set 0) or cutting off the control source power to force the Soft Starter to stop.

IMPORTANT SAFETY POINT

*2: Before resetting the fault status (00008 is set 1) inhibit the Start/Stop signal to check the fault reason otherwise the Soft Starter will start again as soon as the fault status is reset.

2.5 Input/output status (10001...10008)

Address	RS PRO operation	illustration
10001	outside start/stop signal	=0 OFF =1 ON
10002	inside start/stop signal	=0 OFF =1 ON
10003	DIP switch 1	=0 OFF =1 ON
10004	DIP switch 2	=0 OFF =1 ON
10005	Reserve	
10006	Reserve	
10007	Reserve	
10008	Reserve	

2.6 Real-time data (30001...30032 input registers)

Address	RS PRO operation	illustration
30001	A phase current	0...65535 unit: %FLA
30002	B phase current	0...65535 unit: %FLA
30003	C phase current	0...65535 unit: %FLA
30004	Initial voltage	0...512 Initial voltage% =30 +int((512-n)/32)*3
30005	Start time	0...512 Start time= (512-n)/16
30006	Stop time	0...512 Stop time=(512-n)/16
30007	Average current	0...65535 unit: %FLA
30008	Frequency	0...65535 unit: Hz
30009	System status	
30010	Input status	
30011	Fault status	
30012	Accumulated running time	0...65535 unit: hour
30013	Accumulated running time	0...65535 unit:X0.1sec
30014	Number of Starts	0...65535
30015	Number of faults	0...65535
30016	Reserve	
30013	Fault code-1	More detail please check the fault code table
30014	Fault code-2	More detail please check the fault code table
30015	Fault code-3	More detail please check the fault code table
30016	Fault code-4	More detail please check the fault code table
30017	Fault code-5	More detail please check the fault code table
30018	Fault code-6	More detail please check the fault code table
30019	Fault code-7	More detail please check the fault code table
30020	Fault code-8	More detail please check the fault code table
30021	Fault code-9	More detail please check the fault code table
30022	Fault code-10	More detail please check the fault code table
30023...32	Reserve	

Fault code table

Code	Description	Notes
0	No fault	
1	Over-temperature trip	The temperature of the heatsink is higher than temperature setting value
2	Missing phase/No voltage trip	One or two phase voltage failed or no voltage input
3	Over-current trip	Current value exceeds over current set value
4	Over-load trip	Current value exceeds overloading set value
5	Unbalance current trip	The unbalance three-phase current is greater than the unbalance current set value
6	Phase sequence trip	The sequence of three phase voltage is incorrect
7	E ² PROM cannot write trip	Cannot write E ² PROM
8	Other trip	

2.7 Parameter setting (40001...40063 holding registers)

Parameter	MODBUS address	Setting range	Factory setting
Full Load Amps(FLA)	40002	1...100A	According to product
Reserve	40003	0...1	0
Reserve	40004	65535...65535	
Over current protection value	40005	500%-850% FLA	500% FLA
Over current trip delay time	40006	0.1 ... 1SEC	0.1 Sec.
Over-load protection	40007	100-200% FLA	110% FLA
Overload protection Class	40008	0-Class10A, 1-Class10 2-Class20, 3-Class30	0-grade10A
Reserve	40009		
Initial voltage	40010	0...512 $30 + \text{int}((512-n)/32)*3$	potentiometer setting.
Starting time	40011	0...512 $\text{int}(512-n)/16$	potentiometer setting.
Stop time	40012	0...512 $\text{int}(512-n)/16$	potentiometer setting.
Parameter Setting	40013	0-potentiometer setting. 1-communication setting.	According to product
Bypass relay output type	40014	0 - Continuous voltage output for Bypass Contactor coil 1 - Momentary voltage output for Bypass Contactor with self-latching circuit	Factory set According to product. Must not be changed.
Phase sequence protection	40015		
Bypass relay mode	40016	0-Send pulse after bypass 1-Stop pulse after bypass* *see Bypass relay setting 1 above	
Slave machines address	40017	1-127	1
Baud rate	40018	0-1200BPS, 1-2400BPS 2-4800BPS, 3-9600BPS 4-19200BPS	3-9600BPS
Parity check	40019	0-ECC, 1-ODD, 2-NONE	0-ECC



WARNING

The value set must be within the parameter setting range listed. Incorrect parameter setting can cause damage to the Soft Starter.

2.8 Debugging

2.8.1 Instruction

Example 1 Reset fault

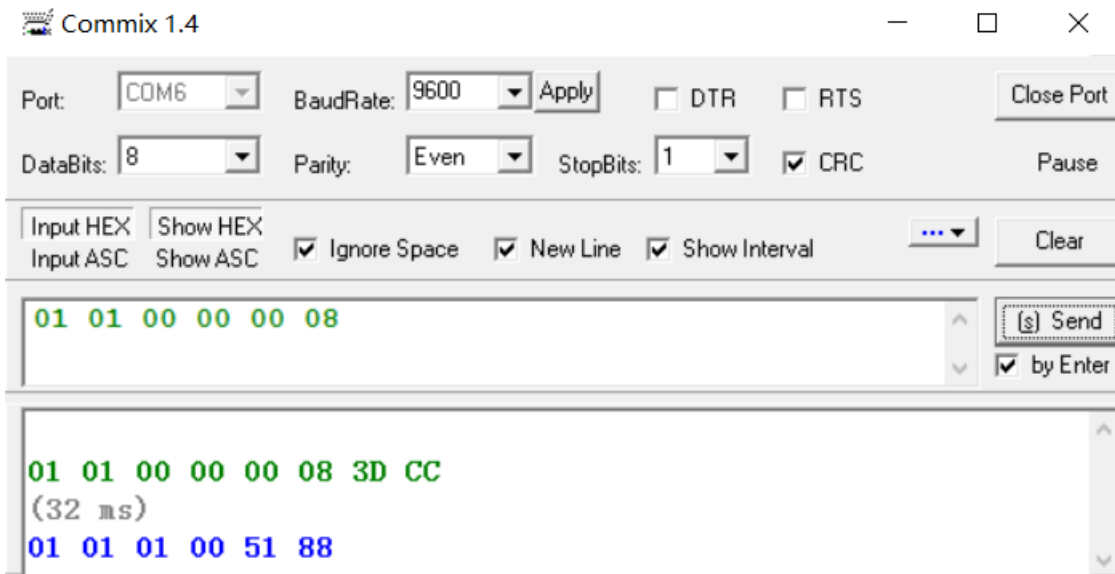
In 2.4 Instruction the coil address of reset fault is 00008. Force single coil through function code '05' of Modbus RTU. Assume the slave number is 1.



Caution:

1. The start address is 0, so the address of 00008 coil is 0x0007
2. The coil set 0, data is 0x0000
3. The coil set 1, data is 0xFF00
4. Returned data
 - 01 slave number
 - 05 function code
 - 0007 coil address
 - FF00 coil set 1
 - 3DFB CRC

Example 2 Read 0001~00008 coil status.



Returned data:

- 01 slave number
- 01 function code
- 01 number of bytes
- 00 coil data
- 5188 CRC

Example 3 force multiple coils.

This example force 00001 and 00002 coil.



Transmitted data:

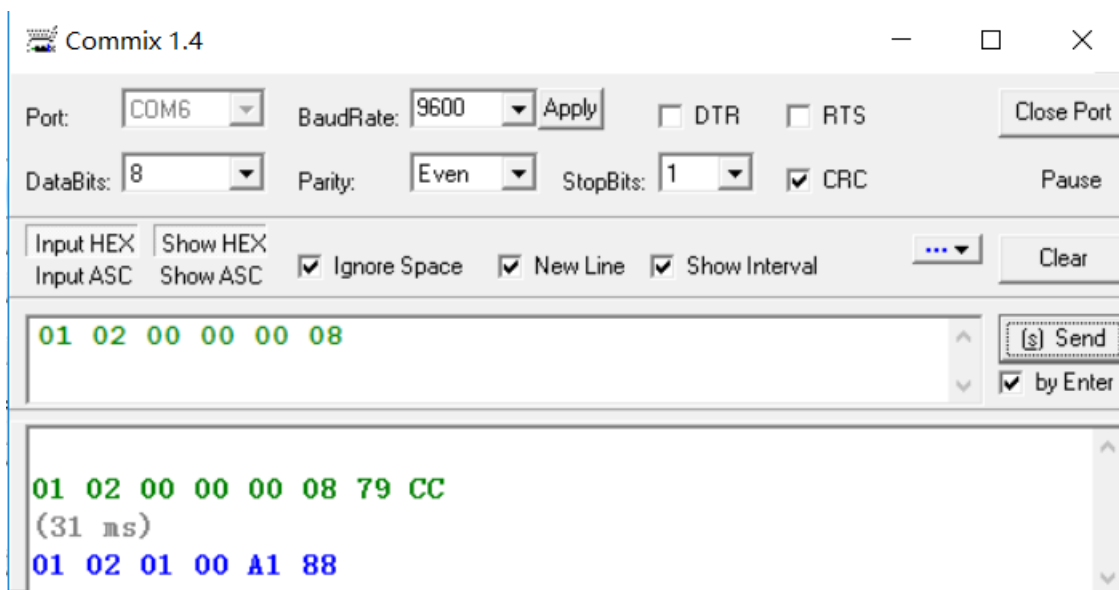
- 01 slave number

0F function code
0000 start address of coil
0002 number of forced coils
01 number of bytes
03 binary data 0000 0011 means two coils set 1

Returned data:
01 slave number
0F function code
0000 start address of coil
0002 number of forced coils

2.8.2 Read Input Status

Example 4 read input status of 10001~10008

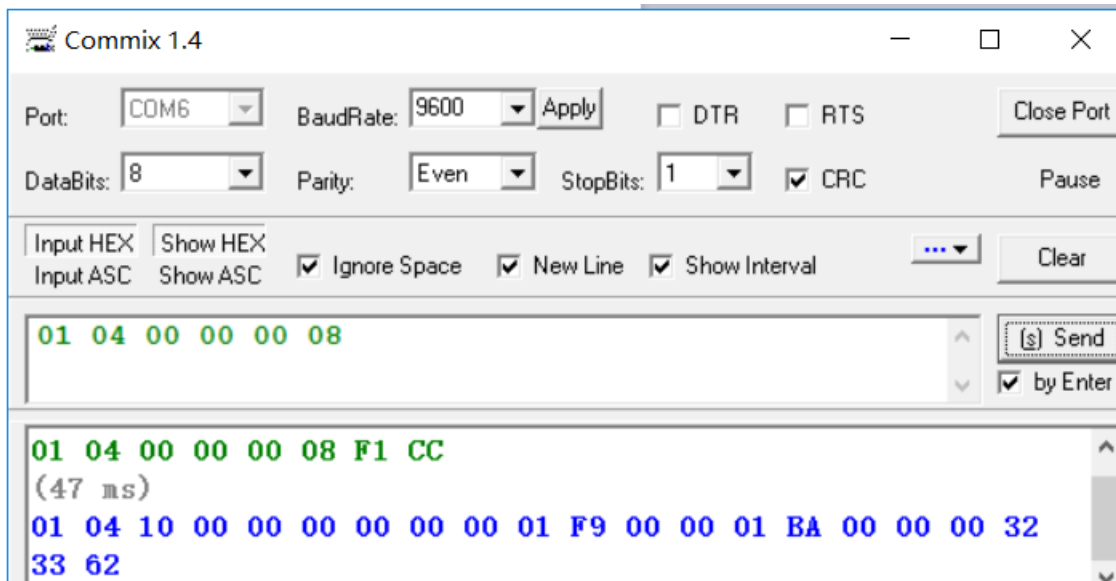


Transmitted data:
01 slave number
02 function code
0000 start address of input status
0008 number of input status read

Returned data:
01 slave number
02 function code
01 number of bytes returned
00 the data of input status returned
A188 CRC

2.8.3 Real-time data

Example 5 read A/B/C phase current, Initial voltage, Start time, Stop time, Average current and frequency.



Transmitted data:

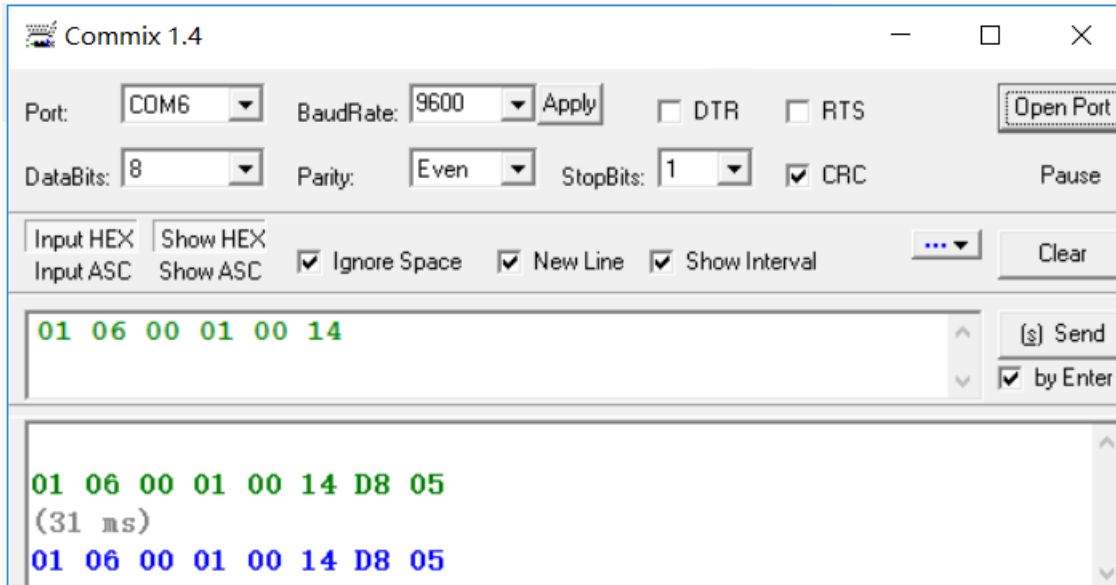
01 slave number
 04 function code
 0000 start address
 0008 number of register read
 F1CC CRC

Returned data:

01 slave number
 04 function code
 10 number of bytes returned (16bytes)
 0000 A phase current
 0000 B phase current
 001C C phase current
 01F9 initial voltage 01F9=505 in decimal system. According to the formula $30 + \text{int}((512-505)/32)*3=30\%$
 0000 start time 0000=0 in decimal system. According to the formula $\text{int}(512-0)/16= 32\text{SEC}$
 01BA stop time 01BA=442 in decimal system. According to the formula $\text{int}(512-442)/16= 4\text{SEC}$
 0009 average current
 0032 frequency
 3362 CRC

2.8.4 Parameter setting

Example 6 set Full Load Amps(FLA)



Transmitted data:

01 slave number
06 function code
0001 address of register
0014 data to set
D805 CRC

Returned data:

01 slave number
06 function code
0001 address of register
0014 data to set
D805 CRC

2.8.5 Diagnostic

Example 7

