PREFACE

Thank you for your choice of EURA DRIVES SoftStarter.
As the return of your trust we will provide the perfect quality and wholehearted service to you.

Adopting modern control theory, modularization design, DSP controlled, high quality material and parts/components, together with advanced SMT manufacturing engineering, HFR1000 series softstarter is a high tech product combing digit, computer and modern automatic control theories. It is characteristic of high performance, high quality and skinny volume, and is widely applicable for starting and protection of three-phase motors in various industries.

Notes

This instruction manual provides information with respects to installation, parameter-setting, trouble-diagnosing and proper operation. This manual should therefore be kept properly and a careful reading shall be required before any operation attempt to avoid any accidental casualties or damage(s) to the facilities.

★ Special Notice:

▲ Installation, operation, maintenance or checking to this product shall be required before reading carefully this instruction manual and ensuring proper use.

▲ Power shall be disconnected before any wiring. Never touch power terminal with hand or conduct object. Never put or drop foreign substance into soft starter.

▲ When using the bypass contactor, please connect the motor according to the recommended diagram in the user‟s manual, that‟s in order to keep the

output exact consistency of softstarter and motor. Otherwise softstarter and motor will be damaged.

▲ Please do not take magneto ohmmeter to measure the insulated resistance between input and output. Otherwise the IGBT and control PCB will be damaged because of high voltage. Please use the magneto ohmmeter to measure the resistance between each phase and between each phase with ground. Also please note that firstly use 3 cables short circuit the each three-phase of input and output separately and take out the entire plugs in control PCB.

▲ Connect input terminals R, S and T to urban power supply of 400V; connect output terminals U, V and W to motor.

▲ Grounding terminal PE  shall be properly earth connected (grounding impedance not exceeding 4Ω).

▲ When terminals R, S and T are connected to power supply of 400V and output terminals U, V and W are not connected to motor, it is normal that the voltage of U, V and W is AC400V. The voltage is got by leakage current of module. After U, V and W are connected to motor, the voltage will clear away.

▲ Capacitance can not be connected to the output of soft starter, but capacitance can be connected to the input of soft starter when it is used for improving power factor.

CONTENTS

I. Product

This manual offers a brief introduction of the installation connection for HFR1000 series softstarters, parameters setting and operations, and should therefore be properly kept. Please contact manufacturer or dealer in case of any malfunction during application.

1.1 Nameplate

Taking for instance the HFR1000 series 15KW softstarter with 3-phase input, its nameplate is illustrated as Fig 1-1.

3Ph: Three-phase input; 400V 50/60Hz: input voltage range and rated frequency.

EURA DRIVES ELECTRIC CO., LTD

SOFTSTARTER IP20

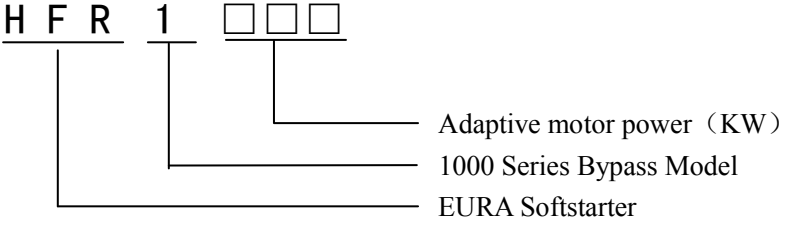
MODEL	HFR1015	SCOPE	AC-53b		
INPUT	3PH AC 400V 50/60Hz				
RATED CURRENT	30A	MATCHED MOTOR	15KW	TRIP CLASS	10

CODE BAR

Fig 1-1 Nameplate Illustration

1.2 Model Illustration:

Taking for instance as the HFR1000 series with 3-phase input



1.3 Appearance

The external structure of HFR1000 series softstarter is classified into plastic and metal housings and all the installation is wall hanging type. Good poly-carbon materials are adopted through die-stamping for plastic housing with nice form, good strength and toughness. Metal housing uses advanced exterior plastic- spraying and powder-spraying process on the surface with elegant color.

1.4 Technical Specifications

Power supply	AC 400V±15%, 50/60Hz (It is supplied by interior, users need not supply power.)	
Input power supply	AC 400V±15%, 50/60Hz	
Applicable motor	Common asynchronism motor	
Startup mode	Voltage ramp startup (1～120 seconds); current limiting startup (150~400% Ie); voltage kick startup	
Stop mode	Free stop; soft stop (1～60 seconds)	
Relay output	Delay running output; fault output; full voltage output (by pass) [contact dot: 5A, 250VAC]	
Startup frequency	for frequent or infrequent startup; Advise: not exceeding ten times per hour	
Protection function	Out phase, over-load, over current over-heating.	
Display	LED nixie tube showing present output frequency, types of faults, and parameters for the system and operation; LED indicators showing the current working status of softstarter.	
Protection level	IP20	
Cooling mode	Cooling naturally	
Installation mode	Hanging type	
Environment conditions	Equipment Location	In an indoor location, Prevent exposure from direct sunlight, Free from dust, tangy caustic gases, flammable gases, steam or the salt-contented, etc.
	Environment Temperature	-10℃～+50℃
	Environment Humidity	Below 90% (no water-bead coagulation)
	Vibration Strength	Below 0.5g (acceleration)
	Height above sea level	1000m or below

1.5 Designed Standards for Implementation

- GB14048.6-2008 Low-voltage switchgear and control-gear contactors and motor-starters Section2: AC semiconductor motor controllers and starters(include softstarter)
- GB14048.6-2008/ EN60947-4-2 Low-voltage switchgear and Control-gear contactors and motor-starters Section2: AC semiconductor

motor controllers and starters (include softstarter)

1.6 Safe instructions

- Please check the model in the nameplate and the rated value of the softstarter. Please do not use the damaged softstarter in transit.
- Installation and application environment should be free of rain, drips, steam, dust and oily dirt; without corrosive or flammable gases or liquids, metal particles or metal powder. Environment temperature within the scope of -10℃～+50℃.
- Please install softstarter away from combustibles.
- Do not drop anything into the softstarter.
- The reliability of softstarter relies heavily on the temperature. The around temperature increases by 10℃, softstarter life will be halved. Because of the wrong installation or fixing, the temperature of softstarter will increase and the softstarter will be damaged.
- Softstarter is installed in a control cabinet, and smooth ventilation should be ensured and softstarter should be installed vertically. If there are several softstarters in one cabinet, in order to ensure ventilation, please install softstarters side by side. If it is necessary to install several softstarters up and down.

1.7 Precautions

1.7.1 Instructions for use

- Never touch the internal elements within 15 minutes after power off. Wait till it is completely discharged.
- Input terminals R, S and T are connected to power supply of 400V while output terminals U, V and W are connected to motor.
- Proper grounding should be ensured with grounding resistance not exceeding 4Ω; separate grounding is required for motor and softstarter. Grounding with series connection is forbidden.
- Load switch is forbidden at output while softstarter is in operation.
- AC reactor or/and DC reactor is recommended when your softstarter is above 37KW.
- There should be separate wiring between control loop and power loop to avoid any possible interference.
- Signal line should not be too long to avoid any increase with common mode interference.
- It shall comply with the requirements for surrounding environment as stipulated in Table 1-1 **"Technical Specifications for HFR1000 Series Softstarter"**.

1.7.2 Special Warning!!

- Never touch high-voltage terminals inside the softstarter to avoid any electric shock.
- All safety covers should be well fixed before softstarter is power connected, to avoid any electric shock.
- Only professional personnel are allowed for any maintenance, checking or replacement of parts.
- No live-line work is allowed.

1.8 Maintenance

1.8.1 Periodic Checking

- Cooling fan and wind channel should be cleaned regularly to check whether it is normal; remove the dust accumulated in the softstarter on a regular basis.
- Check softstarter's input and output wiring and wiring terminals regularly and check if wirings are ageing.
- Check whether screws on each terminals are fastened.
- Check whether softstarter is corrosive.

1.8.2 Storage

- Please put the softstarter in the packing case of manufacture.
- If softstarter is stored for long time, please charge the softstarter within half a year to prevent the electrolytic capacitors damaged. The charging time should be longer than 5 hours.

1.8.3 Daily Maintenance

Environment temperature, humidity, dust and vibration would decrease the life of softstarter so daily maintenance is necessary for softstarter.

Daily inspecting:

- Inspecting for noise of motor when it is working.
- Inspecting for abnormal vibration of motor when it is working.
- Inspecting for the installing environment of softstarter.
- Inspecting for the fan and softstarter temperature.

Daily cleaning:

- Keep the softstarter clean. Clean surface dust of softstarter to prevent dust, metal powder, oily dirt and water from dropping into the softstarter. Inspecting for the fan and softstarter temperature.

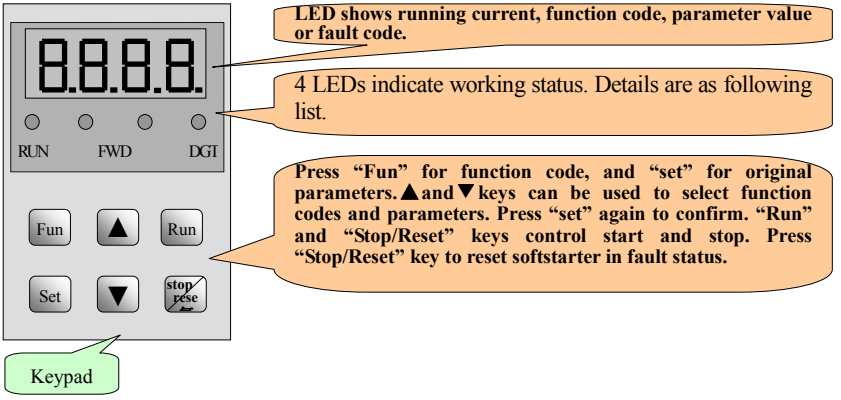
Daily cleaning:

Keep the softstarter clean. Clean surface dust of softstarter to prevent dust, metal powder, oily dirt and water from dropping into the softstarter.

II Keypad Panel

2.1 Panel Illustrations

The panel covers three sections: data display section, status indicating section and keypad operating section



4 LED lights indicate working status:

Indicate Light	Status of Softstarter	Remarks
RUN○ FWD● DGT● FRQ●	Running Status	Light "RUN" is on in running state after startup finished and light is off in standby status.
RUN● FWD○ DGT● FRQ●	Delay Status	Light "FWD" is on when delay begins, and light is off after delay ended.
RUN● FWD● DGT○ FRQ●	External control	Light "DGT" is on when external control works, and light is off in keypad status.
RUN● FWD● DGT● FRQ○	Current Display	Light "FRQ" is on, and current is displayed when pressing FUN key during the startup process; light goes off when pressing it again, and status is displayed.

○ indicates the light is on, ● indicates the light is off

2.2 Panel Operating

All keys on the panel are available for user.

Keys	Names	Remarks
Fun	Fun	To call function code and switch over display mode.
Set	Set	To call and save data.
▲	Up	To increase data (setting parameters)
▼	Down	To decrease data (setting parameters)
Run	Run	To start softstarter
Stop/reset	Stop or reset	To stop softstarter To reset in fault status

2.3 Parameters Setting

User can modify to effect different modes of operation control

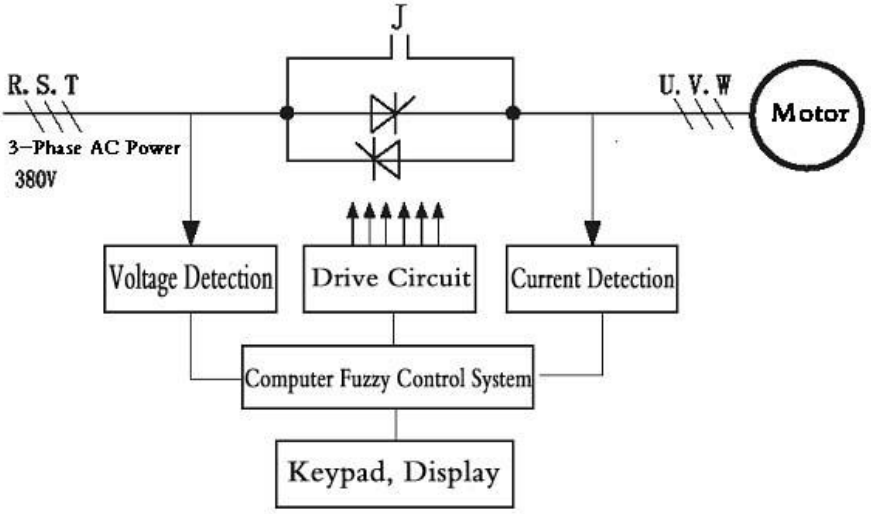
Steps	Keys	Operation	Display
1	Fun	Press "Fun" key to display function code	HF01
2	▲ or ▼	Press "Up" or "Down" to select required function code	HF09
3	Set	To read data set in the function code	150
4	▲ or ▼	To modify data	350
5	set	Finish setting and display present function code	HF09

Panel display

Items	Remarks
-HF-	Reset status
RUN	Startup status
STOP	Stop status
OUT	By pass running status
SST	Soft stop status
DEL_	Startup interval status（During startup interval to operate the displayed item）
PC、OC1、OC2、OL、OH、PF	PC protect, Startup over current 1, Startup over current 2, Startup over load, over heating and out phase.
10	Remain time of delay startup

III Functional Block Diagram

3.1 Functional Block Diagram



Three reverse-parallel connection SCR modules are adopted as power element. By picking up synchronization signal from input voltage sampling, it can pick up output current sampling for feedback fuzzy control, trace the phase automatically and control phase displacement angle. Voltage can thus be increased step by step, and startup current will be under control. After startup, the bypass contactor will make the SCR short circuit. The motor will finally be driven into the electricity network for operation.

IV Installation & Connection

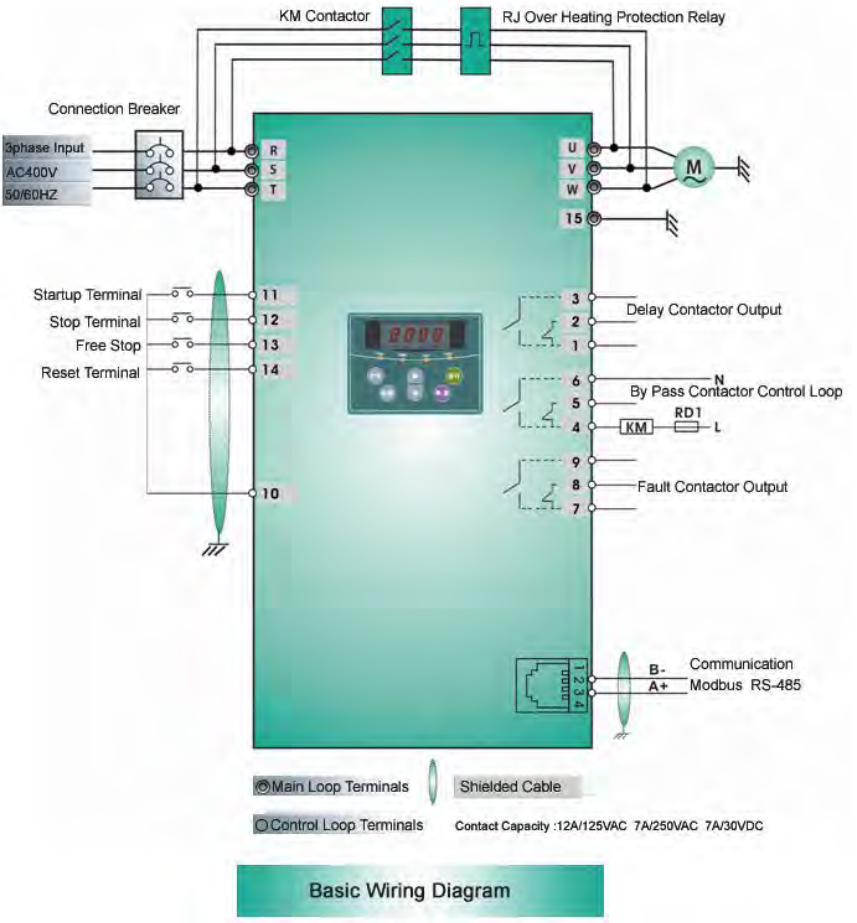
4.1 Power loop wiring

Model	Matched Motor	Rated Current	Lead Section Area(mm^2)	By Pass Contactor Rated Current (Recommended)
HFR1015	15	30	16	35A
HFR1022	22	45	16	50A
HFR1030	30	60	25	65A
HFR1037	37	75	25	80A
HFR1045	45	90	35	100A
HFR1055	55	110	35	120A
HFR1075	75	150	50	165A
HFR1090	90	180	70	190A
HFR1110	110	220	70	250A
HFR1132	132	260	95	280A
HFR1160	160	320	120	350A
HFR1220	220	440	185	500A
HFR1250	250	500	240	500A
HFR1280	280	560	240	600A
HFR1315	315	630	150*2	630A

Remarks:

1. **The rated current value of the by pass contactor selected must be higher than the recommending value.**
2. **The capacity of by pass output relay of the softstarter is 7A/250AC, when the by pass contactor"s loops current is higher than this capacity then add up a middle relay is recommended.**

4.2 Wiring Recommended



Basic Wiring Diagram

R, S, T terminals of softstarter are input terminals while U, V and W are output terminals. QF is auto air breaker, KM is contactor, RJ is over heating protection relay, RD1 is fuse, L11is N connected to 230V. And L11-N is forbidden being connecting to 400V.

! PE Grounding wire should be as short as possible, and should be connected to the nearest grounding point, better on the installation board against the soft starter. Installation board should also be grounded.

! Please connect motor with the phase-sequence recommended by manual. Correctly connect softstarter output with bypass contactor. Otherwise softstarter and motor will be ruined.

4.3 Terminal Function

Y1	Y2	Y3	T1	T2	T3	30A	30B	30C	CM	RUN	STOP	BX	RST	PE
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Terminal Number	Terminal Name	Description	Technical Parameters
Y1	Delay Start Terminal	When delaying start：Y2-Y1 opened, Y3-Y1 closed, the contacts of relay will be reversed after delay start	Capacity:7A/250VAC Y1:middle end Y2-Y1 normally closed Y3-Y1 normally opened
Y2			
Y3			
T1	By pass Contactor Terminal	After startup：T2-T1 open，T3-T1 closed, for turnover to by pass contactor or middle relay after startup	Capacity:7A/250VAC T1:middle end T2-T1 normally closed T3-T1 normally opened
T2			
T3			
30A	Fault Output Terminal	During fault：30B-30A open 30C-30A close，for fault output	Capacity:7A/250VAC 30A:middle terminal 30B-30A normal close 30C-30Anormal open
30B			
30C			
RUN	Startup Terminal	RUN-CM close for startup status	
STOP	Stop Terminal	STOP-CM close for stop status	
BX	Free Stop Terminal	BX-CM close for free stop status	
RST	Reset Terminal	RST-CM close for reset status	
CM	Common Terminal	CM (External control common terminal)	
PE	Ground Terminal	PE connect with ground	

V Function Parameters

5.1 Parameters List

Function No.	Function Explanation	Data Explanation	Mfr Value
HF00	Control mode	0 Keypad control 1 External terminal control 2 Keypad + terminal control 3 Modbus 4 Keypad+terminal+Modbus	2
HF01	Startup mode	0 Voltage ramp startup 1 Current limit startup 2 Kick startup	1
HF02	Startup delay time	0-600S	0S
HF03	Stop mode	0 Free stop 1 Soft stop	0
HF04	Torque compensation	0-50% rated voltage	5%
HF05	Kick voltage	20-80% rated voltage	50%
HF06	Kick time	1-60S	2S
HF07	Ramp ascending time	1-120S	20S (15-30kw) 60S (37-75kw) 100S (90-315kw)
HF08	Ramp descending time	1-60S	2S
HF09	Startup current limit	150-400% rated current	300%
HF10	Startup time interval	1-3600S	240S
HF11	Reverting to Mfr˝s Value	0 No action 1 Action (manufacturer value restored)	0
HF12	Fault memory 1	The latest fault	0
HF13	Fault memory 2	The last but one fault	0
HF14	Fault memory 3	The latest fault current	0
HF15	Reserved		Mfr˝s Value
HF16	PC protection selection	0 Invalid 1 Valid	1
HF17	Voltage ramp OL coefficient	0-60	0
HF18	Out phase selection	0 Invalid 1 Valid	1

HF19	Parity check	0 No check 1 Odd 2 Even	0
HF20	Communication baud rate	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200	2
HF21	Communication Address	1-127: Softstarter address	1
HF22	Selection of ASCII mode and RTU mode	0 ASCII mode 1 RTU mode	0
HF23	Softstarter power	15-315KW	Subject to model
HF24	Close loop Control mode	0 Close loop mode 1 1 Close loop mode 2	0
HF30	Software Edition No.		Mfr"s value
HF25-HF29, HF31	Reserved (Do not change)		Mfr"s value

5.2 Parameters Instruction

HF00	Control mode	0 Keypad control 1 External terminal control 2 Keypad + terminal control 3 Modbus 4 Keypad+terminal+Modbus	2

Control mode selection can be operated directly through the panel keypad, and the manufacturer value is 2.

"Keypad control" refers to the start/stop commands given by the "Run" or "stop/reset" key on the keypad.

"Terminal control" refers to the start/stop command given by the "Run" and "Stop" terminals.

When HF00=3, the running command is given by Modbus.

When HF00=4, keypad + terminal + Modbus command are valid at the mean time.

HF01	Startup mode	0 Voltage ramp startup 1 Current limit startup 2 Kick startup	1

You can start by selecting one of the following three modes：

0 Voltage ramp startup, 1 current limit startup, 2 kick startup, manufacturer value is 1

Δ Voltage ramp startup

Set HF01 to 0, and set ramp startup time t (HF07) and torque compensation voltage (HF04) U0, the motor will start along with the increasing input voltage, and the speed will accelerate accordingly till its top speed, as shown in Fig1.

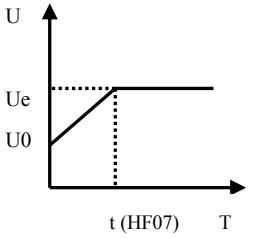


Fig1 Voltage Ramp Startup Feature Curve

Δ Current limit startup

Set HF01 to 1 and set startup current limit percent Is（HF09）and Torque compensation voltage (HF04). The current of the motor will increase until the voltage ramp reaches Is, then it will stop, and the speed will accelerate to its full speed. After that, the current will decrease to below the rated current Ie, as shown in Fig2:

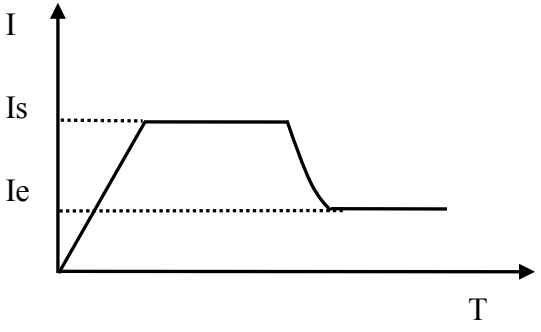


Fig2 Current Limit Startup Feature Curve

Δ Kick startup

Set HF01 to 2, and set ramp start time t (HF07) and torque compensation (HF04), kick time t（HF06）. The motor will start rapidly along with the increasing voltage, then the voltage will increase in a ramp way, and the speed will accelerate to its full speed. It is better for startup motor with big inertia, as shown in Fig3:

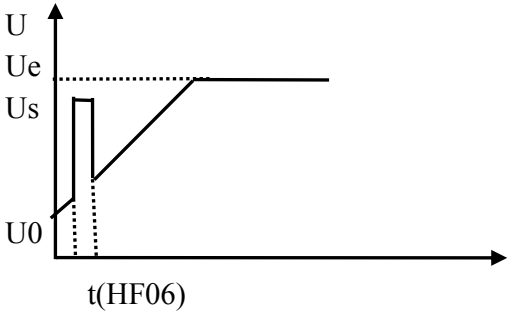


Fig3 Kick Startup Feature Curve

HF02	Startup delay time	0-600	0S

Startup delay time is set for startup preparation, and the motor will not start in this interval. Count down mode is used for display, and the time can be set from 0 to 600 seconds. When start delay, Y2-Y1 open, Y3-Y1 close, Use these two contacts can output a warning signal. The manufacturer value is set to 0S

HF03	Free stop	0 Free stop 1 Soft stop	0

Free stop means that the voltage of softstarter will reduce directly from Ue to 0V，and the motor will run with inertia till its stop, as shown in Fig4:

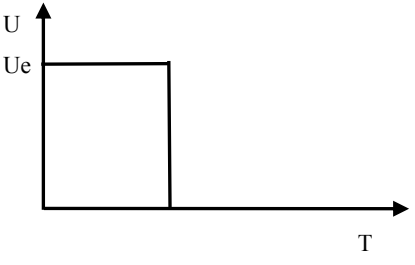


Fig4 Free Stop Feature Curve

Soft stop means that the voltage of starter will reduce gradually from Ue to 0V when the voltage drops. The soft stop can help resist “water hammer domino effect”, as shown in Fig5:

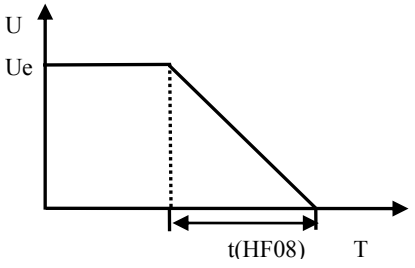


Fig5 Soft Stop Feature Curve

HF04	Torque compensation	0-50% rated voltage	5%

Torque compensation means to adjust the torque produced by initial voltage U0. The manufacturer value is set to 5%. If the load is heavy, please increase HF04. It is valid in voltage ramp startup and current limit startup. Please note that big value"s setting is not recommended, increase gradually the value.

HF05	Kick voltage	20-80% rated voltage	50%

As for a load with big static torque, an instant high voltage must be inflicted, so that it can start smoothly with the torque big enough, the "kick voltage" range is from 20% to 80% percent of the rated voltage. The manufacturer value is set to 50% rated voltage. Please note that big value"s setting is not recommended, increase gradually the value.

HF06	Kick time	1-60S	2S

Kick time means the interval to exert high voltage, adjustable between 1-60S. The manufacturer value is set to 2S.

HF07	Ramp ascending time	1-120S	20S (15-30kw) 60S (37-75kw) 100S (90-315kw)

Ramp ascending time means the interval to bring the voltage from 0V up to rated voltage Ue.

HF08	Ramp descending time	1-60S	2S

Ramp descending time means the interval to bring the voltage from rated voltage Ue to 0V. The manufacturer value is set to 2S.

HF09	Startup current limit	150-400% rated current	300%

It works when HF01 is set to 1, startup current limit = HF09*Ie, please adjust HF09 for a successful start, less current is preferred. Please note that big value"s setting is not recommended, increase gradually the value.

HF10	Startup interval	1-3600S	240S

This equipment is small-sized, and you can only restart it when the radiator cools down from the previous startup, otherwise the machine will stop due to over-heating protection. The startup interval is adjustable, and no more than 10 startups per hour are preferred for full load startups. The manufacturer value is set to 240S.

HF11	Reverting to Mfr"s value	0 no action 1 action (manufacturer value is restored)	0

When the data is in disorder, please restore the manufacturer value by setting data initialization 1.

HF12	Fault memory 1	The latest fault	0
HF13	Fault memory 2	The last but one fault	0

Store and display the code of the last but two fault:

Fault Code	Fault Details
0	No Fault
1	OH Overheating Fault
2	OC Over current Fault
3	PF Out phase Fault
4	OL Over load or jam Fault

HF14	Fault memory 3	The latest fault current	0

The latest fault current is stored in HF14.

HF15	Reserved		Mfr"s value

It"s a reserved parameter and user no need to setup.

HF16	PC protection selection	0 invalid 1 valid	1

When HF16 is set to 1, the function is valid. It is used to protect the setting of motor and softstarter.

HF17	Voltage ramp OL coefficient	0-60	0

Set overload time protection coefficient in the voltage ramp startup. When OL malfunction occurs in the voltage ramp startup, please increase this parameter.

HF18	Out phase selection	0 invalid 1 valid	1

HF18 is out phase selection, 0 means out phase function is invalid, 1 means this function is valid, Mfr"s value is 1.

HF19	Parity check	0 No check 1 Odd 2 Even	0

Set the mode of Parity check. The manufacturer value is set to No check.

HF20	Communication baud rate	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200	2

Set the communication baud rate. The manufacturer value is 4800.

HF21	Communication Address	1-127: Softstarter address	1

Set softstarter address. The manufacturer value is 1.

HF22	Selection of ASCII mode and RTU mode	0 ASCII mode 1 RTU mode	0

Set communication mode. The manufacturer value is set to ASCII mode.

HF23	Softstarter power	15-315KW	Subject to model

Motor power setting is applied for current display warp revising and setting current limited value. The manufacturer value is subject to model.

HF24	Close loop Control mode	0 Close loop mode 1 1 Close loop mode 2	0

Set 0 means close loop mode 1, set 1 means close loop mode 2. The manufacturer value is 0, the close loop mode 1 is fit for most loads, but centrifugal fan or other big inertia load will cause the unsteady starting. The close loop mode 2 is recommended for this situation.

HF30	Software Edition No.		Mfr"s value

HF30 will display the Edition No. of software. User can only check it.

HF25-HF29, HF31	Reserved (Do not change)		Mfr"s value

VI. External Dimension and Mounting Size

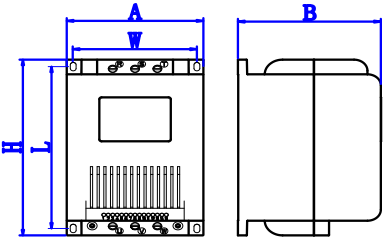
Unit:mm

Model	External Dimension (A×B×H)	Mounting Size (W×L)	Screw	Structure Code	Remarks
HFR1015	153×162×250	140×219	M5	R1	Plastic Hanging Type
HFR1022	153×162×250	140×219	M5	R1	
HFR1030	153×162×250	140×219	M5	R1	
HFR1037	153×162×250	140×219	M5	R1	
HFR1045	153×162×250	140×219	M5	R1	
HFR1055	153×162×250	140×219	M5	R1	
HFR1075	260×194×510	232.5×389	M8	R2	
HFR1090	260×194×510	232.5×389	M8	R2	
HFR1110	260×194×510	232.5×389	M8	R2	
HFR1132	260×194×510	232.5×389	M8	R2	
HFR1160	260×194×510	232.5×389	M8	R2	
HFR1220	360×255×590	300×560	M8	R3	Metal Hanging Type
HFR1250	360×255×590	300×560	M8	R3	
HFR1280	360×255×590	300×560	M8	R3	
HFR1315	360×255×590	300×560	M8	R3	

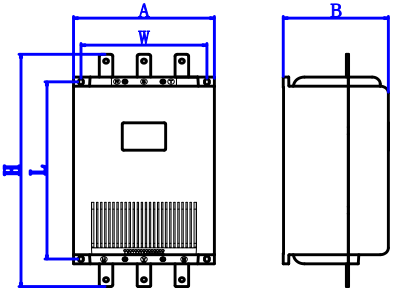
Installation of copper platoon

Structure Code	L1*L2*L3
R2	25 X 480 X 70
R3	34 X 550 X 101

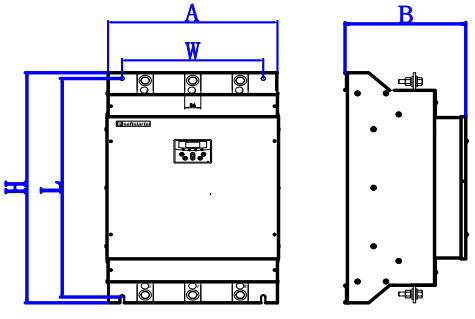
Structure Diagram:



R1 Structure

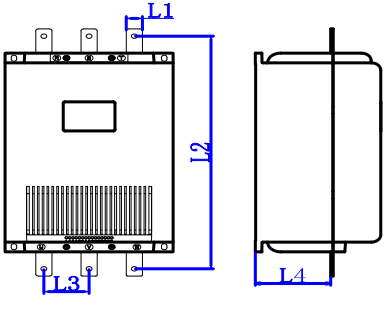


R2 Structure

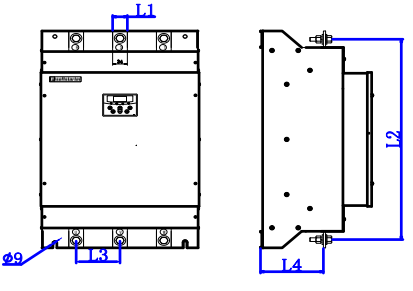


R3 Structure

Copper platoon structure diagram



For R2



For R3

Ⅶ. Appendix

Appendix 1. Trouble Shooting of Keypad Panel Display

Protection function	Display in the panel	Counter measures
Over current	OC1/OC2	*Please decrease HF04 and increase HF07 in the voltage ramp startup. *Please refer to Appendix 2 in the current limited startup.
Out phase	P.F.	*Please check if power input is normal. *If the fault caused by power supply, please set HF18=0, Out phase function is invalid.
Overheat	OH	*Please check softstarter installation environment and improve ventilation; *Please decrease startup times if startup is frequent. *When the temperature fell into the safe range, OH protection stops.
Over load	OL	*Please increase HF17 and HF07 in the voltage ramp startup *Please increase HF09 in the current limited startup.
PC protection	PC	*If softstarter is switched into bypass within 1S during the starting process, “PC” malfunction will display. Please increase HF07 and decrease HF09. If softstarter runs alone without load, “PC” malfunction will display. *If the power of motor and softstarter has a great difference, “PC” will display because starting process is too fast. Please match the right power of softstarter.

Appendix 2. Fault Diagnosis

Problems	Status explanation	Trouble shooting
Motor sounds buzz, when power is on	Soft starter is in standby state	1. Check whether the bypass contactor is blocked at the closed place; 2. Check whether the silicon controlled rectifier (SCR) is spark-through or damaged.
Motor can not work normally with the startup signal input.	Standby status is displayed in the panel	1. In external control state, check whether the terminal RUN-CM is turned on； 2. Check whether the control circuit connection is right, control switch works normally.
	No control power supply state	1. Check whether voltage is normal.
	Wrong parameter set	1. Check every parameter set value one by one, make sure that the set values match the practical parameters of motor; 2. Check the current limit value
	Phase loss occurs during startup	Check three phases‟ voltage, judge whether there is phase loss and eliminate fault
	Wire connection of motor is open	1. Check whether the connection of output terminals of soft starter and what of motor is right and reliable; 2. Check the input terminals‟ voltage, judge whether internal circuit of motor is open; 3. Check whether there is phase loss in input terminal
Startup current exceeds the set value	Current limit function fails	1. Check whether the startup current set is right; 2. Check whether the connection of current mutual inductor is right; 3. Check whether the current mutual inductor works properly, and matches the motor.
	Environment temperature is too high	1. Check whether soft starter installation environment has good ventilation and is installed vertically; 2. Check whether soft starter avoids direct sunlight successfully;
	Over run current of motor	1. Check whether the soft starter has short circuit in output connection ; 2. Check whether overload of motor or damage

		happens; 3. Check whether phase loss fault happens in the motor.
	Soft starter is short circuit between input and output terminal connection	1.Check whether the bypass contactor is blocked at the closed place; 2.Check whether the silicon controlled rectifier (SCR) is sparked through or damaged

☞ **The above problems must be handled by professionals. Users are not allowed for any repair by themselves.**

Appendix 3. Applications (for reference)

Machinery type	Load type	Startup mode		Parameters setting		Startup time (S)	
		Voltage Ramp	Current limited	Torque (%)	Current (%)		
Water pump	Standard load		●	10%	300%	10	30
Fan	A little heave load	●		20%		10	30
compressor (piston-type)	Standard load		●	10%	350%	10	30
compressor (centrifugal)	Standard load	●		15%		10	30
Convey	Standard load		●	10%	300%	10	30
Mixer	A little heave load		●	15%	350%	20	40
Ball crusher	Heavy load	●		30%		30	60
Muller	Heavy load		●	30%	400%	30	60

Users can set the parameters according to actual load.

To a little heavy load and heavy load, the manufacturer recommend user to choose higher power of softstarter. For example: centrifugal fan, mixer, ball crusher and muller. If the load starts frequently (ten times with one hour), please choose higher power of softstarter. Furthermore, the startup mode of "Kick startup" is recommended for heavy load and heavy inertia.

Appendix 4 Communication Manual

(Modbus Version 1.5)

I. General

Modbus is a serial and asynchronous communication protocol. Modbus protocol is a general language applied to PLC and other controlling units. This protocol has defined an information structure which can be identified and used by a controlling unit regardless of whatever network they are transmitted.

Modbus protocol does not require a special interface while a typical physical interface is RS485.

You can read reference books or ask for the details of MODBUS from manufactures.

II. Modbus Protocol

1. Overall Description

(1) Transmission mode

1) ASCII Mode

When controllers are setup to communicate on a Modbus network using ASCII mode, each 8–bit byte in a message is sent as two ASCII characters. For example, 31H (hexadecimal data) include two ASCII characters"3(33H)","1(31H)".

Common characters, ASCII characters are shown in the following table:

Characters	„0"	„1"	„2"	„3"	„4"	„5"	„6"	„7"
ASCII Code	30H	31H	32H	33H	34H	35H	36H	37H
Characters	„8"	„9"	„A"	„B"	„C"	„D"	„E"	„F"
ASCII Code	38H	39H	41H	42H	43H	44H	45H	46H

2) RTU Mode

In RTU mode, one Byte is expressed by hexadecimal format. For example, 31H is delivered to data packet.

(2) Baud rate

Setting range: 1200, 2400, 4800, 9600, 19200

(3) Frame structure:

1) ASCII mode

Byte	Function
1	Start Bit (Low Level)
7	Data Bit
0/1	Parity Check Bit (None for this bit in case of no checking. Otherwise 1 bit)
1/2	Stop Bit (1 bit in case of checking, otherwise 2 bits)

2) RTU mode

Byte	Function
1	Start Bit (Low Level)
8	Data Bit
0/1	Parity Check Bit (None for this bit in case of no checking. Otherwise 1 bit)
1/2	Stop Bit (1 bit in case of checking, otherwise 2 bits)

(4) Error Check

1) ASCII mode

Longitudinal Redundancy Check (LRC): It is performed on the ASCII message field contents excluding the „colon" character that begins the message, and excluding the CRLF pair at the end of the message.

The LRC is calculated by adding together successive 8–bit bytes of the message, discarding any carries, and then two"s complementing the result.

A procedure for generating an LRC is:

1. Add all bytes in the message, excluding the starting „colon" and ending CRLF. Add them into an 8–bit field, so that carries will be discarded.
2. Subtract the final field value from FF hex (all 1"s), to produce the ones–complement.
3. Add 1 to produce the twos–complement.

2) RTU Mode

Cyclical Redundancy Check (CRC): The CRC field is two bytes, containing a 16–bit binary value.

The CRC is started by first preloading a 16–bit register to all 1"s. Then a process begins of applying successive 8–bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC.

A procedure for generating a CRC-16 is:

1. Load a 16–bit register with FFFF hex (all 1"s). Call this the CRC register.
2. Exclusive OR the first 8–bit byte of the message with the high–order byte of the 16–bit CRC register, putting the result in the CRC register.
3. Shift the CRC register one bit to the right (toward the LSB), zero–filling the MSB. Extract and examine the LSB.
4. (If the LSB was 0): Repeat Step 3 (another shift).

(If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).

5. Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8–bit byte will have been processed.

When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

2. Command Type & Format

(1) The listing below shows the function codes.

code	name	description
03	Read Holding Registers	Read the binary contents of holding registers in the slave. (Less than 10 registers once time)

06	Preset Single Register	Preset a value into holding register

(2) Format

1) ASCII mode

Start	Address	Function	Data				LRC check		End	
: (0X3A)	Softstarter Address	Function Code	Data Length	Data 1	… …	Data N	High-order byte of LRC	Low-order byte of LRC	Return (0X0D)	Line Feed (0X0A)

2）RTU mode

Start	Address	Function	Data	CRC check		End
T1-T2-T3-T4	Softstarter Address	Function Code	N data	Low-order byte of CRC	High-order byte of CRC	T1-T2-T3-T4

3) Protocol Converter

It is easy to turn a RTU command into an ASCII command followed by the lists:

1) Use the LRC replacing the CRC.

2) Transform each byte in RTU command into a corresponding two byte ASCII. For example: transform 0x03 into 0x30, 0x33 (ASCII code for 0 and ASCII code for 3).

3) Add a „cdon" (:) character (ASCII 3A hex) at the beginning of the message.

4) End with a „carriage return – line feed" (CRLF) pair (ASCII 0D and 0A hex).

So we will introduce RTU Mode in followed part. If you use ASCII mode, you can use the up lists to convert.

(3) Address and meaning

The part introduces softstarter running, softstarter status and related parameters setting.

Description of rules of function codes parameters address:

1) Use the function code as parameter address

1. General Series:

High-order byte: 01~09 (hexadecimal)

Low-order byte: 00~3C

For example: F114 (display on the board), parameter address is 010E (hexadecimal).

2. Softstarter series

High-order byte: 00

Low-order byte: 00~3C

For example: HF14 (display on the board), parameter address is 000E (hexadecimal).

Note: in this situation, it allows to read six function codes and write only one function code. Some function codes can only be checked but cannot be modified; some function codes can neither be checked nor be modified; some function codes can not be modified in run state; some function codes can not be modified both in stop and run state.

In case parameters of all function codes are changed, the effective range, unit and related instructions shall refer to user manual of related series of softstarters. Otherwise, unexpected results may occur.

2) Use different parameters as parameter address

(The above address and parameters descriptions are in hexadecimal format, for example, the decimal digit 4096 is represented by hexadecimal 1000).

1. Running status parameters

Parameters Address	Parameter Description（read only）
1001	The following is softstarter status. The high-order byte is 0, and low-order byte is the status of softstarter. 0. standby 1. running 2. OC2 protection 3. OC1 protection 4. PF protection 5. OH protection 6. OL protection
1002	Output current

2. Control commands

Parameters Address	Parameters Description（write only）
2000	Command meaning: 0003：Deceleration stop 0004：Free stop 0008：Run（no directions） 0009：Fault reset

3. Communication parameters

Parameters Address	Parameters Description（read only）
2001	Lock parameters 0001：Relieve system locked (remote control locked） 0002：Lock remote control (any remote control commands are no valid before unlocking）

4. Response

Illegal Response When Reading Parameters

Command Description	Function	Data
Slave parameters response	The highest-order byte changes into 1.	Command meaning: 0001: Illegal function code 0002: Address of illegal data 0003: Illegal data 0004: Slave fault

The following is response command when read/write parameters:

Eg1: In RTU mode, change acc time (F007) to 10.0s in NO.01 softatarter.

Host Query

Address	Function	Register Address Hi	Register Address Lo	Preset Data Hi	Preset Data Lo	CRC Lo	CRC Hi
01	06	F0	07	00	0A	8B	0C

Function code F007 Value: 10.0S

Slave Response

Address	Function	Register Address Hi	Register Address Lo	Response Data Hi	Response Data Lo	CRC Lo	CRC Hi
01	06	F0	07	00	04	0A	C8

Function code F007 Do not allow to change

Eg 2：Read status and output voltage from N0.2 softstarter.

Host Query

Address	Function	First Register Address Hi	First Register Address Lo	Register count Hi	Register count L0	CRC Lo	CRC Hi
02	03	10	00	00	02	C0	F8

Communication Parameters Address 1000H

Slave Response：

Address	Function	Byte Count	Data Hi	Data Lo	Data Hi	Data Lo	Crc Lo	Crc Hi
02	03	04	00	02	00	00	68	F3

OC1 protection output current

Eg 3： NO.1 softstarter runs forwardly.

Host Query:

Address	Function	Register Hi	Register Lo	Write status Hi	Write status Lo	CRC Lo	CRC Hi
01	06	20	00	00	01	43	CA

Communication parameters address 2000H Forward running

Slave Response:

Address	Function	Register Hi	Register Lo	Write status Hi	Write status Lo	CRC Lo	CRC Hi
01	06	20	00	00	01	43	CA

Writing parameters successfully

Eg4: Read the value of F017 from NO.2 softstarter

Host Query：

Address	Function	Register Address Hi	Register Address Lo	Register Count Hi	Register Count L0	CRC Lo	CRC Hi
02	03	F0	11	00	01	E7	3C

Communication Parameter Address F011H Reading one Register.

Slave Response:

Address	Function	Register Address Hi	Register Address Lo	Read status Hi	Read status Lo	CRC Lo	CRC Hi
02	03	F0	11	00	04	27	3F

The actual value is 4.

3. Additional Remarks

(1) Expressions during communication course:

Parameter Values of Current＝actual value X 10

Others parameter Values＝actual value X 1

Parameter value is the value sent in the data package. Actual value is the actual value of softstarter. After PC/PLC receives the parameter value, it will divide the corresponding coefficient to get the actual value.

NOTE: Take no account of radix point of the data in the data package when PC/PLC transmits command to softstarter.. The valid value is range from 0 to 65535.

Ⅲ Function codes related to communication

Function Code	Name	Setting Rang	Mfr˝s Value
HF18	Stop bit	0 one bit 1 two bits	0
HF19	Parity Check	0: No check 1: Odd 2:Even	0
HF20	Baud Rate	0 1200 1 2400 2 4800 3 9600 4 19200	2
HF21	Soft starter˝s Address	1-127	1
HF22	ASCII and RTU mode Selection	0 ASCII Mode 1 RTU Mode	0

You can read device status and function code value or preset functions value of soft starter regardless of value of HF00.

Please set functions code related to communication consonant with the PLC/PC communication parameters, when soft starter communicate with PLC/PC.

Ⅳ physical interface

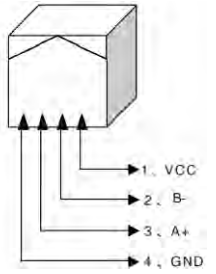
1 interface

Hardware uses communication MAX485, the following are the pin of 485 interface.

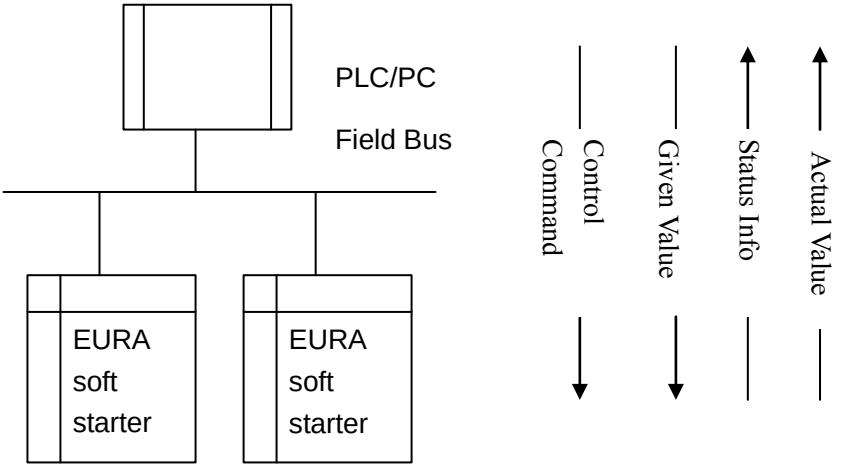
VCC: 5V power supply

GND: ground of 5V

Connect A+ to A+ of PLC or other converter and connect A -to B- of PLC or other Converter, when soft starter communicate to other devices.

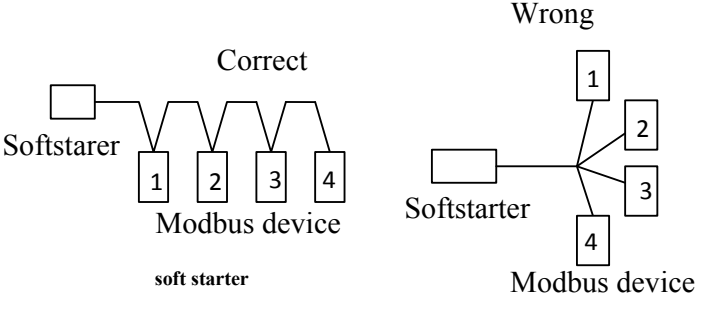


2 Structure of Field Bus

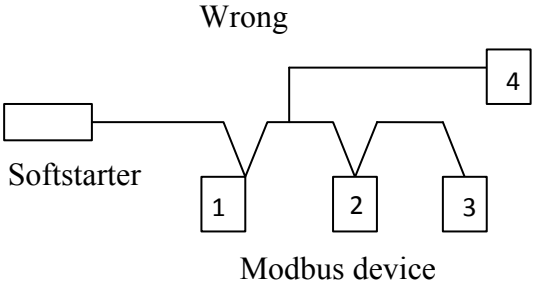


Connecting Diagram of Field Bus

RS485 Half-duplex communication mode is adopted for EURA softstarter.
Daisy chain the devices together. Do not use 'spur' lines, or a star configuration. Terminating Resistors of 120 Ohms should be used on the ends of long modbus/485 loops. In the first example below, the terminator should be placed at the PLC and modbus device 4.



soft starter



Please note that for the same time in half-duplex connection, only one softstarter can have communication with PC/PLC. Should two or more than two softstarters upload data at the same time, then bus competition will occur, which will not only lead to communication failure, but higher current to certain elements as well.

No direct grounding shall be allowed for any point of RS485 network. All the equipment in the network shall be well grounded via their own grounding terminal. Please note that grounding wires will not form closed loop in any case.

Please think over the drive capacity of PC/PLC and the distance between PC/PLC and softstarter when wiring. Add a repeaters if drive capacity is not enough. Modbus repeaters may be used to extend the length of the loop, but introduce delay in the device response time. Using repeaters on slow devices may cause timeout problems.

All wiring connections for installation shall have to be made when the softstarter is disconnected from power supply.

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