HD-PFT-A

Porodriver Function Card

User Manual

V1.1 2018.11

FORWARD

Thanks for your purchasing of Prodriver Function Card HD-PFT-A researched and developed by Hpmont independently. This product is cost-efficient to control small auto-equipment and its volume is small.

This user manual describes product specification, characteristic and use method. It is for your reference.

Before use, please read this user manual carefully and know well about this product characteristic for safe usage.

Note:

- Preserve this manual for future use.
- If you need the user manual due to damage, loss or other reasons, please contact the regional distributor of our company or directly contact our company Technical Service Center.
- If you still have some problems during use, please contact our company Technical Service Center.
- Due to product upgrade or specification change, and for the purpose of improving convenience and accuracy of this manual, this manual's contents may be modified.
- Email address: **overseas_1@hpmont.com**

Version and Revision Records

Version time: July, 2018

Version: V1.1

Chapter	Revised Contents
Chapter 2	• Add CAN communication selection jumper J12, see section 2.3 • Add temperature control input terminal (PT100) wiring, see section 2.4.4
Chapter 3	• Modify the instruction set (logical and functional instructions), see section 3.3 • Modify special address (M and D), see section 3.4
Chapter 4	• Modify Modbus communication use, analog use see section 4.1, 4.3 • Add the use of CAN communication, temperature control see section 4.2, 4.4

CONTENTS

Chapter 1 Safety Information and Precautions

1.1 Design Precautions

Make sure to have safety circuits outside of the PFC to ensure safe system operation even during external power supply problems or PFC failure. Otherwise, malfunctions may cause serious accidents.

- 1) Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
- 2) Note that when the PFC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the CPU occurs in an input/output control block, output control may be disabled. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
- 3) Note that the output current of the service power supply for sensors varies depending on the model and the absence/presence of extension blocks. If an overload occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
- 4) Note that when an error occurs in a relay, triac or transistor output device, the output could be held either on or off. For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

1.2 Wiring Precautions

For installation, wiring, etc., be sure to turn off all power.

Avoid wiring in the live state, plugging and unplugging the cable, otherwise it may cause electric shock or damage to the circuit.

Do not supply power from the outside of the P24 terminal of the process card.

1.3 Environment Requirement

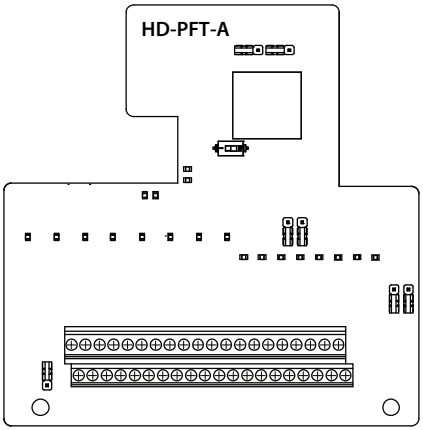
The environment should meet the following requirements:

Working temperature	-10 - +50℃, air temperature change is less than 0.5℃/min
Storage environment temperature	-40 - +70℃
Operation place	Indoor, not exposed to direct sunlight, no dust, soot, conductive dust, corrosive gas, flammable gas, etc
Humitidy	Less than 95%RH, no water condenses
Vibration resistance	3.5m/s^2 in 2 - 9Hz, 10m/s^2 in 9 - 200Hz (IEC60721-3-3)
Level of protection	IP20
Cass of pollution	Level 2 (dry, non-conductive dust pollution)

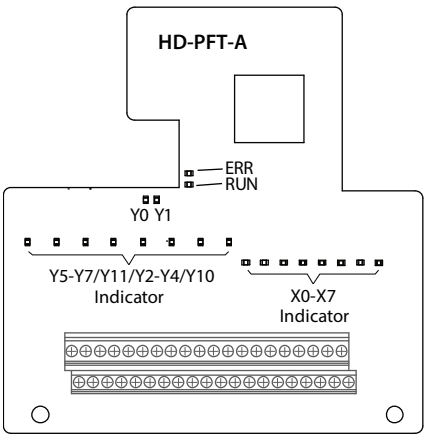
Chapter 2 Product Introduction

HD-PFT-A (FPC) features are as below:

- Programmable memory is used to store instructions such as data processing, sequential control, timing, counting and logic operations. And control various types of devices and production process via digital, analog input and output ports.
- Applications can be written in ladder language or instruction list language, support programming software such as GX Works2, GX Developer.
- Can be connected with a variety of brand man-machine interface, such as Delta, EView, Kunlun state.
- Support Modbus network.

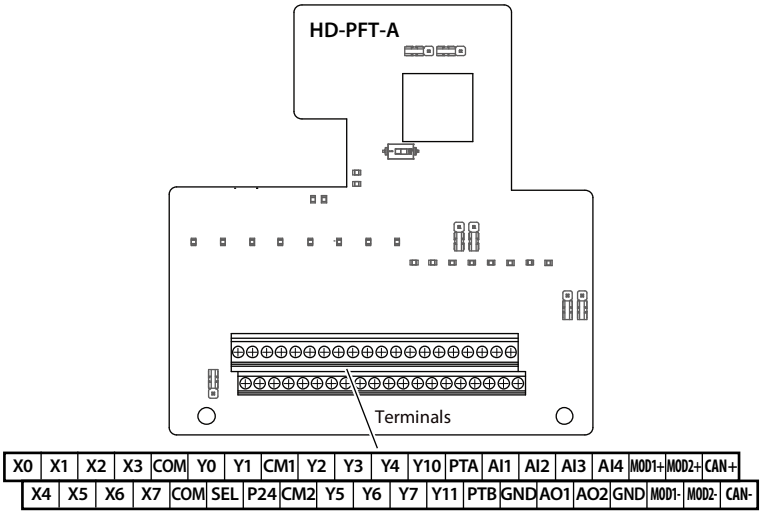


2.1 Indicators



Indicator		Description
X0 - X7	Digital input status indicator	On when valid and off when invalid (green)
Y0 - Y1	Transistor output status indicator	On when valid and off when invalid (green)
Y2 - Y7, Y10, Y11	Relay output status indicator	On when valid and off when invalid (green)
RUN	Run indicator	Always on under mode of RUN and flash under mode of STOP (green indicator)
ERR	Fault indicator	Always on when stop with faulty, flash when not stop with faulty (red indicator)

2.2 Terminals

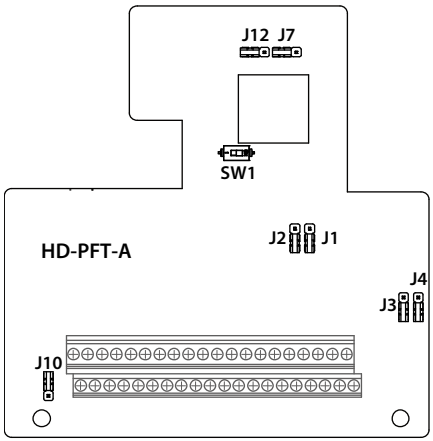


Terminals		Description
AI1, AI2	Analogue input	Input voltage range 0 - 10V, input impedance 44kΩ
AI3, AI4	Analogue input	Input voltage / current optional Input voltage range 0 - 10V, input impedance 44kΩ Input current range 0 - 20mA, input impedance 500Ω
AO1, AO2	Analogue output	Output voltage / current signal: 0 - 10V / 0 - 20mA Programmable output
PTA, PTB, GND	Terperature control input	Platinum resistance thermometer PT100 two-wire input Temperature range: -100 - 250°C (error ±2% / ±1% (after calibration))
X0 - X7	Digital input	Programmable bipolar selectable input signal with input voltage range 0 - 30VDC X0 - X1 input impedance 1.6kΩ, support high speed pulse 50kHz X2 - X7 input impedance 4.7kΩ
Y0 - Y1, COM	Transistor output	Programmable optocoupler isolation, open collector output Output voltage range 0 - 30VDC, maximum output current 50Ma
Y2 - Y7, Y10, Y11/ CM1 - CM2	Relay output	Programmable output, contact capacity: 250VAC/3A or 30VDC/1A, normally open output • CM1 is Y2 - Y4 / Y10 common, CM2 is Y5 - Y7 / Y11 common
P24, COM	Digital power supply	Digital input with +24V power supply, max. allowable output current 200mA
SEL	Digital input common	Factory shorted with P24 • When using an external power supply to drive the X0 - X7, disconnect the J10 short jumper cap J10
GND	+10V power supply ground	Control board +10V power supply reference ground
MOD1+, MOD1-	SCI communication	SCI communication with the inverter

Terminals		Description
MOD2+, MOD2-	Programmable / HMI communication port	Programming interface / HMI communication interface
CAN+, CAN-	CAN communication	CAN communication with the host computer, function development

Note: If the relay terminal is connected to the AC 220V voltage signal, it must be limited to 3A.

2.3 Jumper and DIP Switch



Jumper and DIP Switch	Description
J1 	AI3 analog input voltage / current selection: When 1,2pin is shorted, the AI3 input is the voltage amount (factory setting); When 2,3pin is shorted, the AI2 input is the current amount.
J2 	AI4 analog input voltage / current selection: When 1,2pin is shorted, the AI4 input is the voltage amount (factory setting); When 2,3pin is shorted, the AI2 input is the current amount.
J3 	AO1 analog output voltage / current selection: When 1,2pin is shorted, the AO1 output is the voltage (factory setting); When 2,3pin is shorted, the output of AO1 is the amount of current.
J4 	AO2 analog output voltage / current selection: When 1,2pin is shorted, the AO2 output is the voltage amount (factory setting); When 2,3pin is shorted, the AO2 output is the amount of current.
J7 	SCI communication matching resistor selection: When 1,2pin is shorted, no matching resistor is used (factory setting); When 2,3pin is shorted, match resistor is used.

Jumper and DIP Switch	Description
J12 	CAN communication matching resistor selection: When 1,2pin is shorted, no matching resistor is used (factory setting); When 2,3pin is shorted, match resistor is used.
J10 	SEL short selection: When 1,2pin is shorted, SEL is shorted to P24 (factory setting); When 2,3pin is shorted, SEL is shorted to COM. *Note: The J10 jumper cap must be removed when using an external power supply.*
SW1 	RUN/STOP switch selection: STOP when dialing to the "ON" side; RUN when dialing to the "1" side (factory setting).

2.4 Wiring

2.4.1 Digital Input Terminal (X) Wiring

Dry Contact Method

You can use the internal 24V power supply of the inverter (the SEL and P24 are shorted at the factory) or use an external power supply (remove the shorting cap of J10). The wiring is shown in Figure 2 - 1.

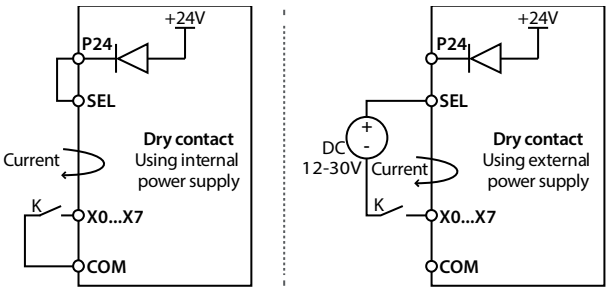


Figure 2 - 1 DI terminal wiring when dry contact

Source (Drain) Mode

Use the source and drain connections of the external power supply, as shown in Figure 2 - 2. (Remove the shorting cap between the SEL and P24 terminals)

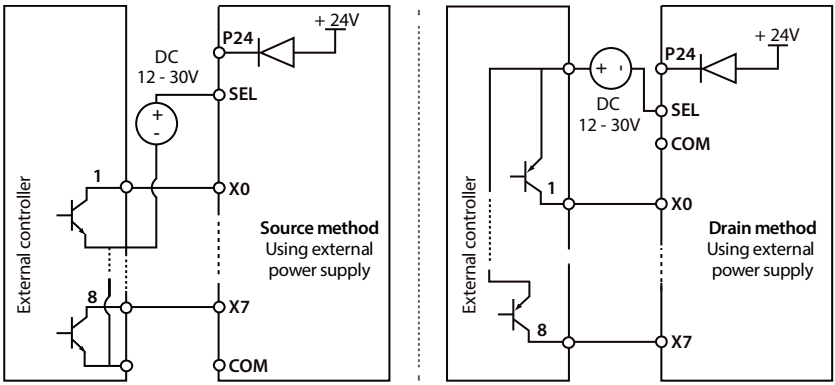


Figure 2 - 2 DI terminal wiring when using external power supply

When using the internal 24V power supply of the driver, the external controller is the connection mode of the NPN type and PNP type common emitter output, such as Figure 2 - 3 shows. (When PNP, remove the J10 shorting cap)

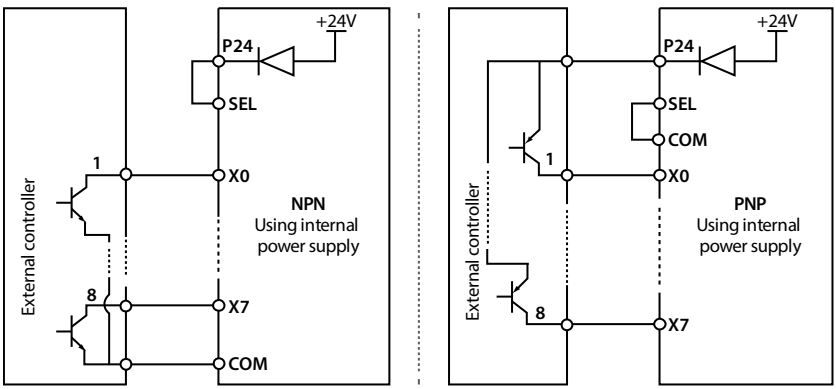


Figure 2 - 3 DI terminal input wiring when using internal 24V power supply

2.4.2 Relay Output Terminal (Y) Wiring

Y0 and Y1 are transistor outputs, the output voltage range is 0 - 30VDC, and the maximum output current is 50Ma. You can use the internal 24V power supply of the driver or use an external power supply. The wiring is shown in Figure 2 - 4.

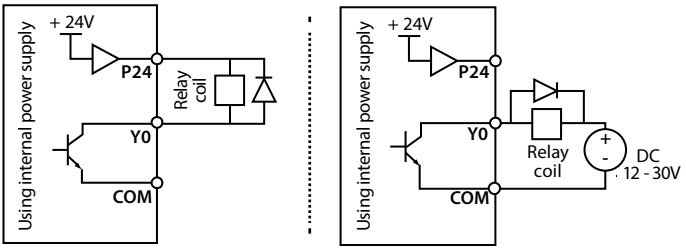


Figure 2 - 4 Transistor output wiring diagram

Figure 2 - 5 shows the internal equivalent circuit diagram of the relay output module. The output terminals are divided into several groups.

CM1 is the common end of Y2 - Y4 / Y10, CM2 is the common end of Y5 - Y7 / Y11, and the output contacts of different groups are connected to different power circuits.

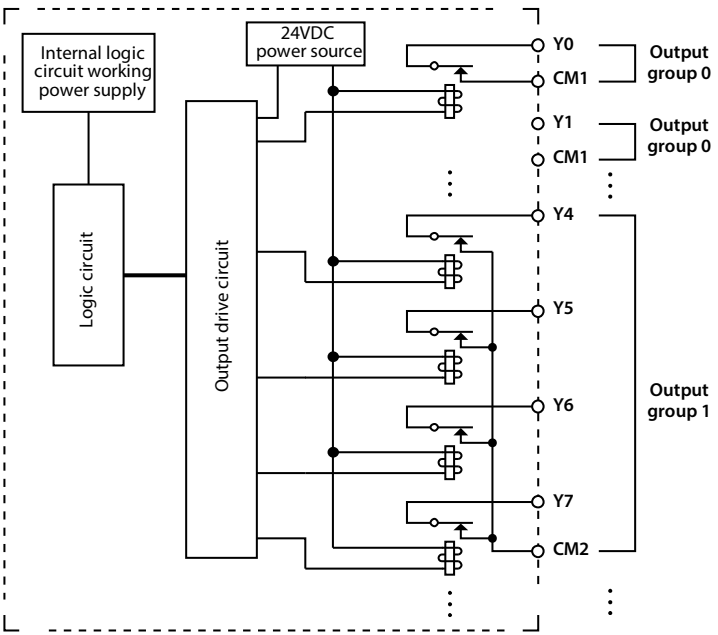


Figure 2 - 5 Relay output equivalent circuit

For inductive loads connected to the AC loop, the external circuit should consider the RC instantaneous voltage sink circuit; for the inductive load of the DC loop, consider adding a freewheeling diode, as shown in Figure 2 - 6.

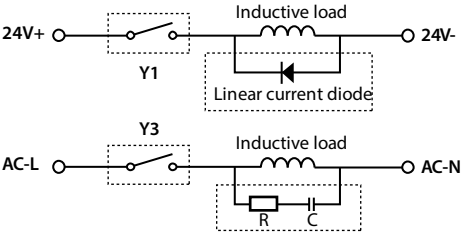


Figure 2 - 6 Relay output connected to inductive load protection circuit

2.4.3 Analog Input Terminal (AI) Wiring

AI1/AI2 is the voltage input, the input voltage range is 0 - 10V, and the wiring is shown in Figure 2 - 7.

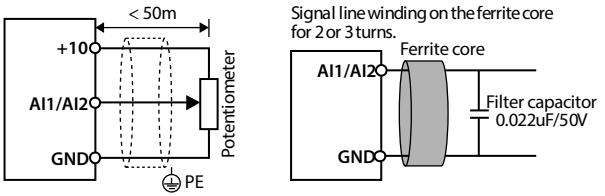


Figure 2 - 7 AI1/AI2 terminal wiring

Note:

1. In order to reduce the interference and attenuation of the control signal, the length of the control cable should be limited to 50m, and the shielding layer is reliably grounded.

2. In the case of serious interference, the analog input signal needs to add filter capacitor or ferrite magnetic ring, as shown in Figure 2 - 7.

AI3/AI4 can be selected as a voltage input with an input range of 0 - +10V. When using the internal 10V power supply, the wiring is the same as AI1/AI2, such as Figure 2 - 7 shows. When using an external +/-10V power supply, the wiring is shown in Figure 2 - 8.

AI3/AI4 can be selected as current input, the input range is 0 - 20mA, and the wiring is shown in Figure 2 - 8.

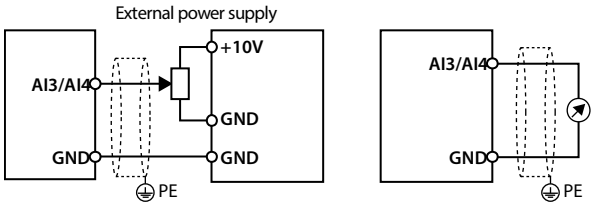


Figure 2 - 8 AI3/AI4 terminal wiring

2.4.4 Temperature Control Input Terminal (PT100) Wiring

PTA/PTB is temperature input, supports two independent PT100 temperature acquisition, input temperature range is -150 - 250℃, control accuracy±2℃, resolution 0.1℃.

The two-wire PT100 input wiring is shown in Figure 2 - 9. If you are using a three-wire PT100, please refer to the two-wire system for wiring. The wire compensation is set by software.

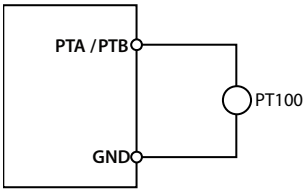


Figure 2 - 9 PTA/PTB terminal wiring

Chapter 3 Functions

3.1 Introduction to Resource Sets

No.	Source	Quantity	Range	Remark
1	Input relay X	8 points	X0 - X7	X0/X1 supports high speed pulse input, X0 - X4 supports external input interrupt
2	Output relay Y	10 points	Y0 - Y7,Y10,Y11	Y0/Y1 is the transistor output and supports high speed pulse output
3	Auxiliary relay M	3072 points	M0 - M3071	Labeled in decimal, generally used M0 - M1023 can be used as power-down save (need to be set)
		256 points	M8000 - M8255	The label is decimal, special use
4	Status relay S	1000 points	S0 - S999	Labeled in decimal, generally used S0 - S999 can be used as power-down save (need to be set)
5	Time relay T	255 points	T0 - T255	• T0 - T199, 100ms non-cumulative type, counting 200 points • (Where T192 - T199 is used for subroutine) • T200 - T245, 10ms non-cumulative type, counting 46 points • T246 - T249, 1ms cumulative type, count 4 points • T250 - T255, 100ms cumulative type, counted 6 points
6	Counter C	245 points Can be saved after power down (need to be set)	C0 - C199	• C0 - C199, 16-bit incremental counter, counts 200 points
			C200 - C234	• C200 - C234, 32-bit reversible counter, counting 35 points
			C235 - C255	• C235 / C241 / C244 / X0 single item count high speed counter • C236 / X1 single item single counting high speed counter • C246 / C247 / C249 / X0 - X1 single double counting high speed counter • C251 / C252 / C254 / X0 - X1 to the high-speed counter counts bis bis *Note: Other counters in this group are temporarily not supported.*
7	Data register D	7000 points	D0 - D7999	Labeled in decimal, generally used D0 - D511 can be used as power-down save (need to be set) D0 - D6999, counting 7000 points
		256 points	D8000 - D8255	The label is decimal and special. D8000 - D8255, counting 256 points
8	Index register V	8 points	V0 - V7	Labeled in decimal, no power outage hold function
9	Index register Z	8 points	Z0 - Z7	Labeled in decimal, no power outage hold function

No.	Source	Quantity	Range	Remark
10	Nested pointer	128 points	P0 - P127	Jump, subroutine, branch pointer
		6 points	I00* - I50*	Input interrupt pointer
		3 points	I6** - I8**	Timer interrupt pointer
11	Decimal constant mark K, H			The constant after the label K is a decimal constant, and the constant after the label H is a hexadecimal constant. Such as H10 = K16
12	The maximum number of support steps is 16K			

3.2 Introduction to Programming and Application

Programming software	Programming software GX Works2 or GX Developer Support ladder programming, download, online monitoring (support 19200bps / 9600bps (M8124 switch))
Programming device	Personal computer: GX Works2, GX Developer runs on Windows operating system (Windows XP, win7, etc.)
Programming and application process description	Product programming generally has the following steps: • Understand the hardware interface (X, Y, AI, AO) and functional requirements of the function process card • Writing ladder programs • Program check and download • Program monitoring and debugging

3.3 Commends Sets Introduction

3.3.1 Basic Logic Commends

Name	Function	Available Devices	Step
LD (LoaD)	NO contact logic operation begins	X,Y,M,S,T,C	1
LDI (LoaD Inverse)	NC contact logic operation begins	X,Y,M,S,T,C	1
LDP (LoaDPulse)	Initial logical operation - rising edge pulse	X,Y,M,S,T,C	2
LDF (LoaD Falling pulse)	Initial logical operation Falling / trailing edge pulse	X,Y,M,S,T,C	2
AND (AND)	Serial connection of NO (normally open) contacts	X,Y,M,S,T,C	1
ANI (AND Inverse)	Serial connection of NC (normally closed) contacts	X,Y,M,S,T,C	1
ANDP rising edge	Serial connection of rising edge	X,Y,M,S,T,C	2
ANDF failing edge	Serial connection of failing edge	X,Y,M,S,T,C	2
OR (OR)	Parallel connection of NO (normally open) contacts	X,Y,M,S,T,C	1
ORI (OR Inverse)	Parallel connection of NC (normally closed) contacts	X,Y,M,S,T,C	1
ORP (OR Pulse)	Parallel connection of Rising edge pulse	X,Y,M,S,T,C	2
ORF (OR Falling pulse)	Parallel connection of Falling / trailing edge pulse	X,Y,M,S,T,C	2
ANB(OR Block)	Serial connection of multiple parallel circuits	X,Y,M,S,T,C	1
ORB (OR Block)	Parallel connection of multiple contact circuits	X,Y,M,S,T,C	1
OUT output	Coil driving	Y,M,S,T,C	1
SET set	Keep action	Y,M,S	2

Name	Function	Available Devices	Step
RST reset	Keep clearing action and clear storer	Y,M,S,T,C,D,V,Z	
PLS rising edge	Rising edge	Y,M (except of special M)	1
PLF failing edge	Failing edge	Y,M (except of special M)	1
MPS (Point Store)	Stores the current result of the internal PLC operations		1
MRD (Read)	Reads the current result of the internal PLC operations		1
MPP (PoP)	Pops (recalls and removes) the currently stored result		1
INV reverse	Invert the current result of the internal PLC operations		1
NOP (No Operation	No operation or null step		1
END end	Forces the current program scan to end		1
MC (Master control)	Denotes the start of a master control block		
MCR (Master Control Reset)	Denotes the end of a master control block		

3.3.2 Basic Functions Commands

Procedures					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
CJ	Conditional jump	IRET	Interrupt return	FEND	First end
CALL	Call subroutine	EI	Enable interrupt	FOR	Start of a for/next loop
SRET	Subroutine return	DI	Disable interrupt	NEXT	End a for/next loop
WDT	Watchdog timer				
Move and Compare					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
CMP	Compare	XCH	Exchange	BCD	Binary coded decimal
ZCP	Zone compare	BMOV	Block move	BIN	Binary
MOV	Move	FMOV	Fill move	SMOV	Shift move
CML	Compliment				
Arithmetic and Logical Operations					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
ADD	BIN addition	INC	BIN increment	WXOR	Word exclusive OR
SUB	BIN subtraction	DEC	BIN decrement	NEG	Negation
MUL	BIN multiplication	WAND	Word AND		
DIV	BIN division	WOR	Word OR		

Rotation and Shift					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
ROR	Rotation right	SFTR	(Bit) shift right	SFWR	Shift register write
ROL	Rotation left	SFTL	(Bit) shift left	SFRD	Shift register read
RCR	Rotation right with carry	WSFR	Word shift right		
RCL	Rotation left with carry	WSFL	Word shift left		
Data Operation					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
ZRST	Zone reset	BON	Check specified bit status	ANS	(Timed) Annunciator set
MEAN	Mean	SUM	The sum of active bits	ANR	Annunciator reset
DEC0	Decode	ENCO	Encode	BON	Check specified bit Status
SQR	Square root	FLT	Float, (floating point)	GRY	Decimal to gray code
GBIN	Gray code to decimal				
Communication					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
RS	485 serial communication	FROM	485 serial read	TO	485 serial write
High Speed Processing					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
REF	Refresh	REFF	Refresh and filter adjust	PWM	Pulse width modulation
SPD	Speed detect	PLSY	Pulse Y output	PLSR	Ramp pulse output
Handy Instructions					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
ALT	Alternate state	RAMP	Ramp - variable value	TTMR	Teaching timer
STMR	Special timer - definable	SER	Search	ABSD	Absolute drum
INCD	Incremental drum	RAMP	Ramp - variable value	SORT	Sort data
Real Time Clock Control					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
TCMP	Time compare	TZCP	Time zone compare	TADD	Time Add
TSUB	Time subtract	TRD	Read RTC data	TWR	Set RTC data
HOUR	TIMER				

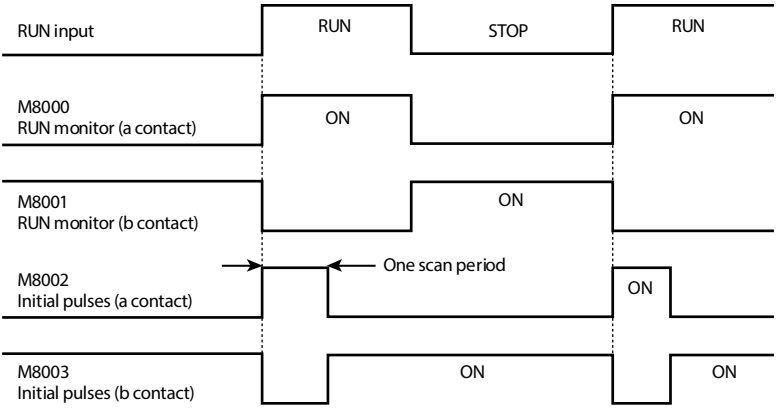
PID					
Symbols	**Functions**	**Symbols**	**Functions**	**Symbols**	**Functions**
PID	PID operation			PID	PID operation

Floating Point			
Symbols	**Functions**	**Symbols**	**Functions**
ECMP	Float compare	ESQR	Float square root
EZCP	Float zone compare	INT	Float to Integer
EBCD	Float to scientific	SIN	Sine
EBIN	Scientific to float	COS	Cosine
EADD	Float add	TAN	Tangent
ESUB	Float subtract	SWAP	Float to scientific
EMUL	Float multiplication	FLT	Used to convert data to and from floating point format
EDIV	Float division		

Contact Compare			
Symbols	**Functions**	**Symbols**	**Functions**
LD=	Contact compare LD (S1) = (S2)	AND<>	Contact compare AND (S1) <> (S2)
LD>	Contact compare LD (S1) > (S2)	AND<=	Contact compare AND (S1) <= (S2)
LD<	Contact compare LD (S1) < (S2)	AND>=	Contact compare AND (S1) >= (S2)
LD<>	Contact compare LD (S1) <> (S2)	OR=	Contact compare OR (S1) = (S2)
LD<=	Contact compare LD (S1) < = (S2)	OR>	Contact compare OR (S1) > (S2)
LD>=	Contact compare LD (S1) > = (S2)	OR<	Contact compare OR (S1) < (S2)
AND=	Contact compare AND (S1) = (S2)	OR<>	Contact compare OR (S1) <> (S2)
AND>	Contact compare AND (S1) > (S2)	OR<=	Contact compare OR (S1) <= (S2)
AND<	Contact compare AND (S1) < (S2)	OR>=	Contact compare OR (S1) >= (S2)

3.4 Special Address

3.4.1 Special M Address



PLC Status			
M8000	RUN monitor (a contact)	M8002	Initial pulses (a contact)
M8001	RUN monitor (b contact)	M8003	Initial pulses (b contact)
M8004	Error reminder		
Clock Pulses			
M8011	10 millisecond clock pulse	M8013	1 second clock pulse
M8012	100 millisecond clock pulse	M8014	1 minute clock pulse
Marks			
M8020	zero	M8024	BMOV transmit direction
M8021	Borrow	M8026	RAMP mark postion
M8022	Carry	M8029	end of command exctuting

PLC			
M8034	All outputs are disabled	M8036	Forced RUN signal
M8035	Forced operation mode	M8037	Forced STOP signal
Annunciator			
M8048	Annunciator ON	M8049	Enable annunciator monitoring
Disable			
M8050	I00□ disable	M8054	I40□ disable
M8051	I10□ disable	M8056	I6□□ disable
M8052	I20□ disable	M8057	I7□□ disable
M8053	I30□ disable	M8058	I8□□ disable
Error Code			
M8061	PLC hardware error	M8065	Syntax error
M8063	Parallel link / ADP error	M8066	Program error
M8064	Parameter error	M8067	Operation error

RS485 Communication			
M8123	Finished receiving data		
Programming Port Baud Rate Selection			
M8124	OFF: 19200bps (default) ON: 9600bps		
CAN Communication flag			
M8152	CAN communication completion flag	M8155	CAN communication error flag
Up/Down Counter Control			
M8200 - M8234 (35 pcs)		C200 - C234 (46 pcs), up/down counter direction	
High Speed Counter Control			
M8235	C235 counter direction	M8246	C246 counter direction
M8236	C236 counter direction	M8247	C247 counter direction
M8241	C241 counter direction	M8249	C249 counter direction
M8244	C244 counter direction		
Others			
M8255	Reserved		

3.4.2 Special D Address

Special D Address					
D6999	Internal occupancy, do not use	D8000	Scan time	D8005	battery voltage (only 2s before power-ondetection)
D8010	Current scan time (0.1ms)	D8012	Scan maximum time (0.1ms)	D8013	Second
D8014	Minute	D8015	Hours	D8016	Day
D8017	Monthes	D8018	Year	D8019	Weeks
D8020	Input terminal filtering time (10ms)	D8021	PLC software version number	D8028	The contents of the Z0 register
D8029	The contents of the V0 register	D8049	Signal alarm ON state minimum number	D8061	PC hardware error number
D8063	RS485 communication error code	D8064	Parameter error number	D8065	Syntax error number
D8066	Loop error number	D8067	Operation error number	D8068	Error step number latch
D8069	Error step number	D8110	Terminal expansion card scan time	D8111	Terminal expansion card 1
D8112	Terminal expansion card 2	D8113	Terminal expansion card 3	D8114	Terminal expansion card 4
D8115	Terminal expansion card 5	D8120	MOD1 RS485 communication parameters	D8121	MOD1 RS485 target slave address (MOD1 is the host)
D8122	MOD1 RS485 slave address	D8124	MOD2 RS485 slave address	D8126	Communication interval (MS)
D8129	RS485 communication timeout judgment time	D8136	Y000, Y001 output pulse number accumulation sum (low position)	D8137	Y000, Y001 output pulse number accumulation sum (high position)

Special D Address					
D8140	Y000 cumulative pulse number (low)	D8141	Y000 cumulative pulse number (high)	D8142	Y001 cumulative pulse number (low)
D8143	Y001 cumulative pulse number (high)	D8144	Y000 high speed pulse duty cycle (unit 0.1%, 0 - 1000, default 500) *Note: The duty cycle can be set within 20K, but when the frequency is high, the delay of the circuit will bring a large error. Please use it within 1K.*	D8145	Y001 high speed pulse duty cycle (unit 0.1%, 0 -1000, default500)
D8150	CAN baud rate	D8151	CAN section No.	D8152	CAN communication time out judgment time
D8155	CAN communication error code	D8160	AO1 high check value	D8161	AO1 low check value
D8162	AO2 high check value	D8163	AO2 low check value	D8170	AI1 high check value
D8171	AI1 low check value	D8172	AI2 high check value	D8173	AI2 low check value
D8174	AI3 high check value	D8175	AI3 low check value	D8176	AI4 high check value
D8177	AI4 low check value	D8182	Z1 register	D8183	V1 register
D8184	Z2 register	D8185	V2 register	D8186	Z3 register
D8187	V3 register	D8188	Z4 register	D8189	V4 register
D8190	Z5 register	D8191	V5 register	D8192	Z6 register
D8193	V6 register	D8194	Z7 register	D8195	V7 register
D8235	X0 filter value coefficient (0 - 15, default 15) 0 : No filter, press fDTS sampling frequency 1: fSAMPLING = fDTS, N = 2 2: fSAMPLING = fDTS, N = 4 3: fSAMPLING = fDTS, N = 8 4: fSAMPLING = fDTS/2, N = 6 5: fSAMPLING = fDTS/2, N = 8 6: fSAMPLING = fDTS/4, N = 6 7: fSAMPLING = fDTS/4, N = 8 8: fSAMPLING = fDTS/8, N = 6 9: fSAMPLING = fDTS/8, N = 8 10: fSAMPLING = fDTS/16, N = 5 11: fSAMPLING = fDTS/16, N = 6 12: fSAMPLING = fDTS/16, N = 8 13: fSAMPLING = fDTS/32, N = 5 14: fSAMPLING = fDTS/32, N = 6 15: fSAMPLING = fDTS/32, N = 8 *Note: fSAMPLING is the sampling frequency, fDTS = 80M, and N is the number of samples. Final filter time = 1 / (fSAMPLING * N) . The larger the coefficient value, the longer the filtering time.*				
D8236	X1 filter value coefficient (0x00 - 0x0F, default 0x0F)	D8240	AI1	D8241	AI2
D8242	AI3	D8243	AI4	D8244	AI5 (expansion card 1 AI1)
D8245	AI6 (expansion card 1 AI2)	D8256	PTA temperature measurement (0.1°C)	D8257	PTB temperature measurement (0.1°C)
D8248	AO1	D8249	AO2	D8250	AO3 (expansion card 1 AO1)
D8251	AO4 (expansion card 1 AO2)	D8252	PTA temperature zero offset calibration bit (0.1°C)	D8253	PTB temperature zero offset calibration bit (0.1°C)

Chapter 4 Usage

4.1 Modbus Communication

The HD-PFT-A provides two RS485 communication interfaces (MOD1/MOD2).

- MOD1 communicates in MODBUS RTU mode. Can act as a slave or host.
- MOD2 can be used as a programming port or MODBUS slave interface (supports 19200bps and 9600bps, 1-8-1 has no parity, and cannot be set to 0x85, 0x82, 0x05, 0x02 four station addresses).

4.1.1 Special Address

<table>
<tr><th>Address</th><th>Specification</th></tr>
<tr><td>D8120</td><td>Define MOD1 communicaiton parameter, default 0x8089, the specific meaning is shown in the table below.
<table>
<tr><th rowspan="2">Position</th><th rowspan="2">Itme</th><th colspan="3">Content</th><th rowspan="2">Remark</th></tr>
<tr><th colspan="2">0 (bit OFF)</th><th>1 (bit ON)</th></tr>
<tr><td>b0</td><td>Data length</td><td colspan="2">7 digits</td><td>8 digits</td><td rowspan="4">Set according to the actual situation</td></tr>
<tr><td>b2&b1</td><td>Parity</td><td colspan="3">00: NONE 01: ODD 11: EVEN</td></tr>
<tr><td>b3</td><td>Stop bit</td><td colspan="2">1 bit</td><td>2 bits</td></tr>
<tr><td>b7&b6&b5&b4</td><td>Transfer rate (bps)</td><td colspan="3">0110: 2400bps 1001: 19200bps 1100: 115200bps
0111: 4800bps 1010: 38400bps
1000: 9600bps 1011: 57600bps</td></tr>
<tr><td>b8 - b14</td><td>Not use</td><td colspan="2"></td><td></td><td></td></tr>
<tr><td>b15</td><td>Master and slave selection</td><td colspan="2">Slave</td><td>Host</td><td></td></tr>
</table>
The communication parameter settings are recommended to be set during the first execution cycle of the first part of the user program.
The default is 0x8089, which is the data format 1-8-2, no parity, baud rate 9600bps, as the host.
Note: The data length is fixed to 8 bits in RTU mode and 1 to Bit0.</td></tr>
<tr><td>D8121</td><td>Slave address of RS command communication (PLC is the host, 0 - 255 (0 is the broadcast frame))</td></tr>
<tr><td>D8122</td><td>PLC MOD1 port number (PLC MOD1 port slave, 0 - 255)</td></tr>
<tr><td>D8124</td><td>PLC MOD2 port number (PLC MOD2 port slave, 0 - 255, does not include 0x85, 0x82, 0x05, 0x02)</td></tr>
<tr><td>D8126</td><td>Communication interval. The D8126 defaults to 30.
When the PLC is the host, the current communication ends to the waiting interval of the next frame communication, and the minimum is twice the time for sending 3.5 bytes at the current baud rate. It is used to prevent the communication from being sent too fast and the slave can not recognize it.</td></tr>
<tr><td>D8129</td><td>Timeout judgment time (ms), factory value 200ms.
When the process card is used as the host, it starts timing from the transmission of data, and when there is no data reception within D8129, the communication times out.</td></tr>
</table>

<table>
<tr><th>Address</th><th>Specification</th></tr>
<tr><td>D8063</td><td>Communication error code.
<table>
<tr><td>0</td><td>Meaningless, initial value</td><td>122</td><td>Receive error code, unsupported operation (no support for attributes, factory values, upper and lower limits, etc.)</td></tr>
<tr><td>1</td><td>Normal communication</td><td>123</td><td>Receive error code, request frame register</td></tr>
<tr><td>2</td><td>Over time of communication</td><td>124</td><td>Receive error code, information frame error, including information length error and verification error</td></tr>
<tr><td>010</td><td>Send error code, illegal command code (host only)</td><td>132</td><td>Receive error code, parameters cannot be modified</td></tr>
<tr><td>011</td><td>Send error code, send data length error (host only)</td><td>133</td><td>Receive error code, parameter cannot be modified while it is running</td></tr>
<tr><td>012</td><td>Unsuccessful delivery</td><td>134</td><td>Receive error code, parameters are password protected</td></tr>
<tr><td>101</td><td>Receive error code, illegal command code</td><td>140</td><td>Receive error code, the receiving data station address is inconsistent with the sending data station address (host communication)</td></tr>
<tr><td>102</td><td>Receive error code, illegal register address</td><td>141</td><td>Receiving error code, receiving data command code is inconsistent with sending data command code (host communication)</td></tr>
<tr><td>103</td><td>Receive error code, data error</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>M8063</td><td>Communication error flag: The communication flag is set after the communication is completed or an error occurs, and continues until the next communication starts.</td></tr>
<tr><td>M8123</td><td>Communication completion flag: The communication flag is set after the communication is completed or an error occurs, and continues until the next communication starts.
Note: Do not use the M8123 communication completion flag to start the next communication, and timing errors may occur.</td></tr>
</table>

4.1.2 Communication Support MOUBUS Function Code

Code	Definition	Code	Definition
0x01, 0x02	Read one or more bits, ranging from 1 - 512	0x06	Write a register, range 1
0x03, 0x04	Read one or more registers, ranging from 1 - 32	0x0F	Write multiple bits, ranging from 1 - 512
0x05	Write a bit, range 1	0x10	Write multiple registers, ranging from 1 - 32

Note:

When the command word 0x05 is used, the coil is turned off (set to 0) when the local data is 0x0000, and turned on (set to 1) when it is 0xFF00.

4.1.3 Communication Address

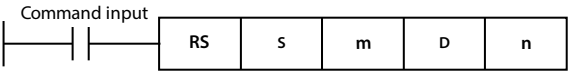
Bit Component	Address Number (16 digits)	Register	Address Number (16 digits)
M0 - M1535	0x0000 - 0x05FF	D0 - D7999	0x0000 - 0x1F3F
M8000 - M8255	0x1E00 - 0x1EFF	D8000 - D8255	0x1F40 - 0x203F
S0 - S999	0x2000 - 0x23E7	T0 - T255	0xA140 - 0xA23F
T0 - T255	0x3000 - 0x30FF	C0 - C199	0xA340 - 0xA407
C0 - C255	0x3200 - 0x32EF	C200 - C255 (32bit occupy two bits)	0xA408 - 0xA477
Y0 - Y267	0x3300 - 0x33B7		
X0 - X267	0x3400 - 0x34B7		

4.1.4 Usage

Host

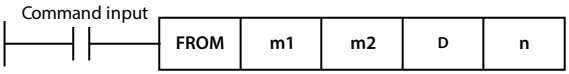
The host supports three commands of RS, FROM, and TO (double-byte and pulse formats are not supported at this time), and the PLC automatically polls and transmits the command for conditional conduction.

RS: The slave address of the communication is set by D8121 and needs to be set before the RS command is used.



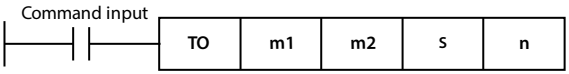
Operand Type	Content	Data Type
S	Command word D	D (16 bits)
m	Target start address of the target slave	D, K/H (16 bits)
D	Component length (1 - 512)	D (16 bits)
n	Local data (storing data when reading, storing data to be written when writing)	D, K/H (16 bits)

FROM: Read-only, support for command words 0x01, 0x02, 0x03, 0x04.



Operand Type	Content	Data Type
m1	High eight-bit command word (default is 0x3, input command word is not supported and is also 0x3) Low eight-bit slave address (0x00 - 0xFF)	K/H
m2	Target slave start address	K/H
D	Receive data storage address	D
n	Component length (1 - 512)	K/H (1 - 215)

TO: Write only, support command words 0x05, 0x06, 0x0, 0x10.



Operand Type	Content	Data Type
m1	High eight-bit command word (component length 1 defaults to 0x06, greater than 1 defaults to 0x10) Low eight-bit slave address (0x00 - 0xFF)	K/H
m2	Target slave start address	K/H
S	The data to send	D, K/H
n	Component length (1 - 512)	K/H (1 - 215)

Slave

The MOD1 slave device needs to set "communication parameters (D8120)" and "station number (D8122)" to communicate.

The MOD2 slave only needs to set the station number (D8124), the communication format only supports 1-8-1, no parity, 19200bps / 9600bps (M8124 switch).

4.2 CAN Communication Use

HD-PFT-A provides one CAN communication interface. 120Ω matching resistors are connected to the CAN interface. When wiring, only CAN+ and CAN- of two cards can be connected to each other for CAN communication.

For CAN communication, each card should be assigned a separate node point number to support multi-master and multi-slave.

4.2.1 Special Address

<table>
<tr><th colspan="5">CAN Equipping</th></tr>
<tr><th>Address</th><th colspan="4">Description</th></tr>
<tr><td>D8150</td><td colspan="4">Baud rate: 5K, 8K, 10K, 20K, 40K, 50K, 80K, 100K, 125K, 200K, 250K, 400K, 500K, 800K, 1M
• Support the above 15 baud rates, set to the corresponding value, the default is 500K.
• When the set value is between the two, configure a small baud rate, such as input 600, configured to 500K.</td></tr>
<tr><td>D8151</td><td colspan="4">CAN section points number (supports 1 - 127, of which 1 - 6 can be used as the main card, the default is 1)</td></tr>
<tr><td>D8152</td><td colspan="4">Timeout judgment time (ms), factory value 20ms.
When the process card is used as the host, it starts timing from the transmission of data, and when there is no data reception within D8129, the communication times out.
• Includes EXTR instructions and CAN extended terminal scans.</td></tr>
<tr><td>D8155</td><td colspan="4">CAN communication error number.
<table>
<tr><td>0</td><td>Meaningless, initial value</td><td>122</td><td>Receive error code, unsupported operation (no support for attributes, factory values, upper and lower limits, etc.)</td></tr>
<tr><td>1</td><td>Normal communication</td><td>123</td><td>Receive error code, request frame register</td></tr>
<tr><td>2</td><td>Over time of communication</td><td>124</td><td>Receive error code, information frame error, including information length error and verification error</td></tr>
<tr><td>010</td><td>Send error code, illegal command code (host only)</td><td>132</td><td>Receive error code, parameters cannot be modified</td></tr>
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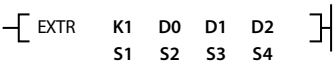
<tr><td>101</td><td>Receive error code, illegal command code</td><td>140</td><td>Receive error code, the receiving data station address is inconsistent with the sending data station address (host communication)</td></tr>
<tr><td>102</td><td>Receive error code, illegal register address</td><td>141</td><td>Receiving error code, receiving data command code is inconsistent with sending data command code (host communication)</td></tr>
<tr><td>103</td><td>Receive error code, data error</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>M8152</td><td colspan="4">CAN communication completion flag. The communication flag is set after the CAN communication command EXTR is completed, and continues until the next communication starts.</td></tr>
<tr><td>M8155</td><td colspan="4">CAN communication error flag. The communication flag is set after the CAN communication command EXTR error, and continues until the next communication starts.</td></tr>
</table>

CAN Expansion Terminal Scanning	
Address	**Description**
D8110	CAN expansion terminal scanning period (ms) • When there are multiple expansion terminal cards, wait for this time between each card, ie scan cycle = D8110 * Total number of cards used. • The D8110 has a minimum of 20ms. When set to 0, it does not scan.
D8111	Expand the terminal card 1 (the lower eight bits are the expansion card section point number, the upper eight bits are the communication status (see D8155))
D8112	Expand the terminal card 2 (the lower eight bits are the expansion card section point number, the upper eight bits are the communication status (see D8155))
D8113	Expand the terminal card 3 (the lower eight bits are the expansion card section point number, the upper eight bits are the communication status (see D8155))
D8114	Expand the terminal card 4 (the lower eight bits are the expansion card section point number, the upper eight bits are the communication status (see D8155))
D8115	Expand the terminal card 5 (the lower eight bits are the expansion card section point number, the upper eight bits are the communication status (see D8155))

4.2.2 Communication Command EXTR

The host supports EXTR (does not support double byte and pulse form) commands for CAN communication. The conditional conduction starts to be sent, and after the communication is completed, it automatically switches to the next ONTR instruction.

If the communication is incorrect, it will be resent automatically. If the communication fails after the timeout period expires, switch to the next one.



Operand Type	Content	Type of Data
S1	component length	K/H
S2	high eight-bit command word, low eight-bit slave address (0x00 - 0xFF)	D
S3	slave data start address	D
S4	local data start address	D

Note:

1. The command word and communication address are consistent with MODBUS communication. For details, refer to section 4.1 Modbus Communication.

2. The component length S1 reads and writes to multiple registers (0x03, 0x04, 0x06) in the range of 1 - 2, and reads and writes multiple bits (0x01, 0x02, 0x0F) in the range of 1 - 32.

4.2.3 CAN Expansion Terminal Card Scanning

The process card supports up to 5 cards from the card to automatically expand the XY input and output points through CAN communication, and the first card also supports the expansion of two-way AI and two-way AO.

When using the CAN expansion terminal, you need to set the extended terminal scan period (D8110) to wait for each communication.

- When there are multiple expansion terminal cards, wait for this time between each card, that is, the scan period of the expansion terminal = D8110 * the total number of cards used.
- The D8110 has a minimum of 20ms. When set to 0, it does not scan.

D8111 - D8115 is set to the section point number (1 - 127) corresponding to the extended terminal card setting. The upper eight bits display the communication status, and the meaning is the same as the error number of D8155. Unexpanded expansion cards are skipped and not scanned.

The XY state of each expansion card will be filled backwards in turn, the expansion card 1 is X020 - X027 and Y020 - Y011, and the expansion card 2 is X040 - X047 and Y040 - Y051. And so on.

- Expansion card 1 will also expand AI1/AI2 to AI5 (D8244) / AI6 (D8245), and expand AO1/AO2 to AO3 (D8150) / AO4 (D8151).

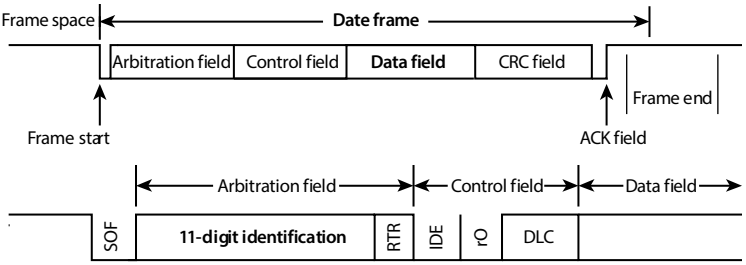
When using the expansion card to expand, you need to ensure that the expansion card is in the RUN state, and set the baud rate and station number to match.

Additional resources need to be expanded by the communication command EXTR.

4.2.4 CAN Communication Protocol

Standard Data Frame

The card CAN communication uses the 11-bit identifier flag frame format.



Support CAN2.0A standard format, the identifier (ID) length is 11 bits.

Data Frame Format

11-bit Identifier			Data Field (Fixed 8 Byte)				
Bit10	Bit7 - 9	Bit0 - 6	Byte 0	Byte 1 - 2	Byte 3	Byte 4 - 5	Byte 6 - 7
S/R	Main ID	Slave ID	Command word	starting address	length	Data content	Data content

The system supports up to 127 nodes (1 - 127), of which the first 6 points can be used as hosts (1 - 6, capable of sending active read and write commands), and the remaining nodes can only support slaves. The reply priority is higher than the request, the smaller the station number, the higher the priority.

11-bit Identifier	
S/R	Send/return flag. 1: The host sends a request to the slave. 0: The slave responds to the host with a request.
Main ID	Host section of this communication, point number, 1 - 6, 0-bit special command. • No section 7 points Avoid high 7 digits all 1.
slave ID	The slave section number of this communication, 1 - 126, 0 is the broadcast frame.
0000xxxxxxx: Reserved for system detection. 1000xxxxxxx: Reserved.	
Data Field	
Command word	Consistent with MODBUS command word.
Start address	The start address of the read/write slave data is consistent with the MODBUS communication address.
Length	Request frame: The length is the number of data requested to read and write, register type 1 - 2, bit type 1 - 32.
	Return frame: The write command data frame is consistent with the request frame content. The read command returns the frame length as the number of bytes occupied by the data content, and the range is 1 - 4.
Data field	Fixed two words, the unused content is automatically filled with 0.

4.3 Analog Usage

Address

The analog address is read and written directly to the operation of the special address.

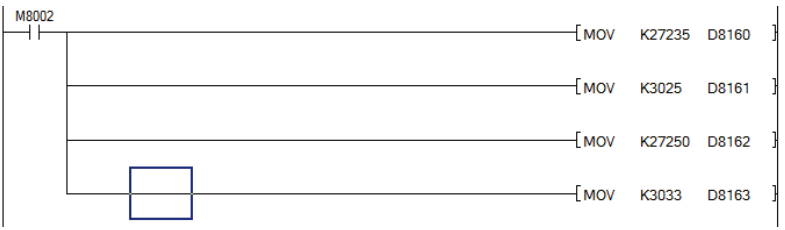
Category	Terminal	Address	High Correction Value	Low Correction Value
Analogue input	AI1	D8240	D8170	D8171
	AI2	D8241	D8172	D8173
	AI3	D8242	D8174	D8175
	AI4	D8243	D8176	D8177
	A15	D8244	AI5 is to expand the AI1 of the card 1, and calibrate the AI1 calibration of the expansion card 1.	
	AI6	D8245	AI6 is to expand the AI2 of card 1, calibrate the AI2 calibration of the expansion card 1.	
Analogue output	AO1	D8248	D8160	D8161
	AO2	D8249	D8162	D8163
	AO3	D8250	AO3 is to expand the AO1 of the card 1, and calibrate the AO1 calibration of the expansion card 1.	
	AO4	D8251	AO4 is the AO2 of the expansion card 1, calibrating the AO2 calibration of the expansion card 1.	

Usage

After the wiring is completed, the analog input and output operations can be realized by directly reading and writing the corresponding address, and 0 - 10V corresponds to 0 - 30000.

- For AI, the high correction value is filled with the current analog reading at 9V (about 27000 adjustment), and the low correction value is filled with the analog reading at 1V (around 3000 adjustment) to complete the correction.
- For AO, correct the input value when the high and low correction value addresses are filled with the actual output equal to 9V and 1V, respectively.
- Correction is only performed when the high and low correction value addresses are filled in and within a reasonable range (between 0 - 30000 and the high correction value > low correction value). If you need to correct it yourself, fill in the corresponding correction value at the corresponding high and low correction value address.
- AI5, AI6, AO3, AO4 are CAN expansion analog terminals, need to use CAN expansion card 1, for specific usage, see section 4.2 CAN Communication Use.

High and Low Correction Example



4.4 Temperature Control Use

Item	Celsius
Input	Signal
Sensor	Current
Rated	Temperature
Effective	Digital
Resolution	0.1
Comprehensive	Accuracy

The PFT-A supports two PT100 temperature measurements using a two-wire connection. When using, connect the two pins of different colors of PT100 to PTA and GND or PTB and GND respectively. For the three-wire connection, the other pin of the PT100 is left unconnected.

After the connection is completed, the temperature measurement value of the PT100 connected to the corresponding pin can be obtained by reading D8246 (PTA) and D8247 (PTB).

- D8252 (PTA zero offset calibration bit) and D8253 (PTB zero offset calibration bit) can be used for zero offset calibration, calibration lead wire error and temperature drift.
- Temperature measurements and temperature calibrations are worth 0.1 degree of minimum scale, ie 20.0℃ reading position 200.

Calibration:

The PFT-A achieves an accuracy of ±1% after calibration without regard to line resistance. However, due to the influence of the storage environment, working environment and wiring errors, the measurement results will have a certain deviation. In the normal working environment and storage and transportation environment, the error caused by the zero offset is within ±2%.

This offset can be compensated by calibration. The internal calibration formula of the program: **D8246 = measurement result + D8252 + factory calibration**.

- The factory calibration results are solidified inside the program and cannot be modified by the user. It is mainly calibrated by filling in the difference between the measured result and the actual temperature in D8252 and D8253.
- Since the PT100 changes by approximately 0.385Ω at approximately 1 degree, the line resistance also produces a large error and cannot be ignored. After the PT100 is connected, it can be calibrated uniformly with the actual temperature. It is also possible to subtract 1 degree per 0.385Ω, calculate the deviation caused by the line resistance, and then bring it into the formula for calibration.
- It can be seen from the calibration formula that although the temperature control range of the card is -1000 - 2500, the calibration will cause the range to shift the calibration value up or down as a whole.
- When the PT100 measures a temperature that is outside the range of the range or is connected to a larger resistor, the card temperature will be displayed as 0.

4.5 Power-down Save Data Usage

The battery needs to be installed when using power-down save. The power-down storage range is divided into: fixed power-down storage area, and power-down storage area can be set.

The range of the power-down save area can be set in the device settings in the PLC parameters, as shown in the figure below (the parameters need to be downloaded to the PLC to be valid after modification).

The fixed power-down save area is D512 - D1500.

In the non-fixed power-down save area, the data will be cleared to 0 (except for special registers) during STOP-RUN, and the value of the power-down save area will not be changed. Please note that there may be initial values in this part of the area.

4.6 Program Protection

Setting the M8255 once enables the protection of the ladder program in the process card, and then reading the ladder can only read the empty program.

The protection function can be cancelled only by downloading a new program different from the encryption program to overwrite the encryption program.

After downloading the same program as the encryption program, the process card is still encrypted.