Yudian AIBUS & MODBUS COMMUNICATION PROTOCOL INSTRUCTION (V8.0)

Developed by Xiamen Yudian Automation Technology Co., Ltd., AIBUS is the communication protocol designed for AI-series displaying and controlling instruments. It functions by easy instructions and is characterized by the function of setting and reading parameters at the same time. Thus, Circle Time is not damaged while setting parameters. With its shorter instruction length, AIBUS has quicker rate than MODBUS(especially when setting instruction in MODBUS, it cannot be read meanwhile since circle time will be influenced and prolonged). AIBUS has system control ability to construct large scale process. It exploits 16 bit SUM correcting code, operates with higher speed and more reliable communication since it supports 9600, 19200 and other wave frequencies. With 19200, the average time for an upper computer to visit a high performance controller like AI-7/8 series is only 20 mS, and AI-5 series is 40mS. One RS485 is allowed to connected with up to 80 pc of controllers (to promise the reliability of communication, one RS485 repeater is added when over 60 pc). Al sereis controllers can be connected with touch screen and PLC with full resource and higher speed. PC is widely used when under WINDOWS operation environment for its conveniece and powerful function. The application of the latest Industrial PC touch screen further brings a new environment to industrial automation. This results in the much lower cost and much higher performance of controllers+PC much than that of the traditional DCS. Yudian's AI-5 series controllers have as long life as 1 million times while AI-7/8 is allowed to continue setting parameter, like PV,SV, the highest is 1 billion times, and can be used in complicate regulating system.

-, interface specification

Al series instruments adopt Asynchronous Serial Port, interface level is in accordance with RS232C and standard RS485. Data format is 1 start bit, 8 bit data, no check-bit, 1-2 stop-bit. Wave frequency rangs from 4800~19200 bit/S, usually 9600 bit/S. 19200 bit/S is suggested when over 40 pc instruments or require higher refresh rate. 4800 bit/S is suggested when with longer communication length and interruption. Al controllers adopt RS 485 and can connect 1~80 pc to one communication interface.

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It only needs 2 wires to communicate AI controllers and PC when the length is over 1 KM(some are 3-4KM), which is advantageous compared with RS 232. To make sure PC can be connected, RS232/RS485 or USB/RS485 converters can be used, changing RS232 or USB interfaces into RS 484 interface. Yudian has developed new RS232/RS485 and USB/RS485 converters with litter volume and certain thunder-proof ability. No initialization is needed nor outer power supply. All software can be adjusted to use.

As RS 485 interface required, it can connect up to 32 controllers and computers with one communication line. Repeaters is needed when over 32 pc. Or use 1/2 and 1/4 off-chip interface. At present, AI interface can connect 60 pc without repeater and is thunder-proof and electrostatic-proof to some degree.

Al's RS 232 and RS485 interfaces adopt advanced optical isolated technology, when there is damage or fault in one pc, operation of others is not influenced. When parts of communication interface or model is failed, controllers keep working with high reliability. 16 bit correct code has a high accuracy as

high as 30000 times than parity check, can promise the reliable data. Under most conditions AI controllers are not influenced by other brand's product communication. No disordered data collecting. But AI controller protocol doesn't promise other brand's product can work normally so Yudian doesn't suggest to use Yudian's controllers with other brand's controllers on one RS485 communication line. Separated connection is better.

\equiv , Communication Instruction

Al controllers adopt 16 bit data format to symbol all instruction codes and datas. After optimization of software communication instruction, there are only two: reading instruction and writing instruction. These two instructions make it easier to compile software with 100 % fulless. The standard reading and writing instructions formation are as follows:

Reading: address code+52H(82)+ parameter code+0+0+check code

Writing: address code+43H(67)+ parameter code+low byte+high byte+check code Address code: in order to connect more AI controllers to one communication interface, each controller has its own communication address. Some valid addresses are 0~80 (some are 0~100), so up to 80 pc are connectable. Address code depends on Addr Parameter. Two repeated 128~208 (80H~D0H) is used to symbol address code. Since code over 128 is seldom used, thus it can reduce the data and address clashes. AI protocol requires, address code is formed by two same bytes, value is : address+80H as follows:

E.g.: If the parameter Addr=10(16 bit is 0AH,0A=80H= 8AH), then its address code is 8AH 8AH.

Parameter code: controllers' parameter is formed by 1 8-bit binary number (1 byte, write as 16 number). It indicates the reading and writing parameter.

Check code: it is formed by 16bit SUM correct coding. Its computational method is:

Parameter code to be read*256+82+ADDR

Writing instruction's correct code's computational method is the remainder of the below formula: Parameter code to be read*256+67+parameter to be written+ADDR

ADDR above is the address parameter of controller, range is 0~80. Correct code is the remainder of the above formula: 2 bytes, former is low byte, latter is high byte. Values to be written is indicated by 16 bit binary number.

Return data: writing or reading whichever, below 10 bit data is returned:

PV+SV+MV and alarm status+writing/reading parameter value+ correct code

Thereinto, PV ,SV, and reading values each takes up 2 bytes, symbolizing one 16-bit binary number has twos complement, with low byte in front and high byte behine. Decimal point is not represented, so users should do on PC; MV takes up 1 byte in 8 signed binary number format, value range is -100~+100, status take up 1 byte, correct code take up 2 bytes, totalling 10 bytes. The meaning of all returned datas are as follows:

Codes	Regulator	AI-708M	AI-708H/808H	AI-808H	AI-301M
	Controller	Indicator	Flow channel	Temp./ Pressure	Frequency
				channel	regulator/IO module
PV	Testing value	Testing value	Flow testing value	Temperature testing value,0.1 ℃	Testing value
SV	Setting value	Channel number	Accumulated flow low level or batch control testing	Pressure testing value,0.001MPa	Current setting value

		(1-6)	value				
MV	Output	Status	Accumulated flow	Flow	or	Regulating	output
	value, ivi v	Dytes B	nigh level of batch	rrequency	value	value	
Status	Status	Status	control setting	before		Status bytes A	
bytes	bytes A	bytes A	value	compensat	ion,0.		
				1Hz			
Parameter value	Meaning val	ues to be rea	d and written.				

Returned correct code equals the remainder of the formulat: PV+SV+ (alarm status*256+MV)+parameter +ADDR

When calculating, every two 8-bit byte forms one 16-bit binary number. The remainder is correct Status byte A symbols some controllers' status, its meaning is as follows (NO.7 is fixed with" 0"):

	Regulator/ indicator(V7.0)	AI-702M/704M/706M	Regulator, indicator (V7.5)
NO.0	High limit alrm (HIAL)	High limit alrm (HIAL)	HIAL
NO.1	Low limit alrm (LoAL)	Low limit alrm (LoAL)	LoAL
NO.2	positive deviation alarm (dHAL)	0	HdAL
NO.3	negative deviation alarm (dLAL)	0	LdAL
NO.4	Input over range alarm (orAL)	Over range alarm (orAL)	Oral
NO.5	AL1status, 0 movement	0	Stand-by (0)
NO.6	AL2status, 0 movement	0	0,output value MV,1 status byte B

Indicators has status byte B. With B, NO.0-6 stand for the interface respectively for OP1,OP2, AL1, AL2, AU1, AU2 and MIO, 0 stands for no connection or no output, 1 stand for outer on/off connected and output, OUTP or AUX correspond to 0. Their corresponding interfaces can be input and output for on/off switch, the alarm interfaces not used by ALP can be used as I/O interface for on/off switch by modifying NONC(normally opened/ closed): "opened" is set for input, when read input signal is 1, it means outer on/off is closed or there is signal input.

Parame	AI-518/518P	Specification	06H(MODBU
ter		·	S address)
code			ŕ
00H	(SV)	Unit same as MV	40001
01H	HIAL (high limit alarm)	Unit same as MV	40002
02H	LoAL(low limit alarm)	Unit same as MV	40003
03H	dHAL(Deviation high	Unit same as MV	40004
	alarm)		
04H	dLAL (Deviation low	Unit same as MV	40005
	alarm)		
05H	AHYS(Alarm	Unit same as MV	40006
	Hystersis)		
06H	CtrL (Control mode)	0, ONOFF; 1, APID; 2, nPID; 3, PoP; 4, SoP	40007
07H	P(Proportional band)	Unit same as MV	40008
08H	I (Time of Integral)	S	40009
09H	d (Time of Deviative)	0.1s	40010
0AH	Ctl(Control period)	0.1s	40011
0BH	InP(Input type)	Refer to manual	40012
0CH	dPt(Radix point	0, 0; 1, 0.0; 2, 0.00, 3, 0.000; If above read-in data	40013
	position)	+128, it means all MV and their parameters with same	
		unit(for either temperature signal or linear signal),	
		should be display after devided by 10 and then " 4	
		pieces into 5" process。For example, dPt value as	

Parameter list (V8.0 518/518P/708/708P/719/719P)

16 integer is 1000, And it is to be displayed as 10.0 actually (Ir dPr value is 1, and actual display is 1000; bits parameter could be written in, but shouldn' t add 128, the range for self written in is 0-3. 0DH Sct1 (Signal scale low limit) Unit same as MV 40014 0EH Sct1 (Signal scale low lingh limit) Unit same as MV 40015 0FH ALF(Alarm ouput selection) Refer to manual 40016 11H OPT(Main output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40018 12H OPT(Output tow limit) % 40020 13H OPH(Output towillimit) % 40021 14H CF (Communication function) Refer to manual 40021 15H Model Tagged word 5180(AL518) or5187 (AL518P) 40022 16H Addr (Address) 40024 40025 17H FILL (Orgital Filtering) 0, run; 1, StoP; 2, FMAn; 3, FAut 40027 18H* Addr (Madress) 0, run; 1, StoP; 2, HoLd 40028 16H Addr (Address) 0, or run; 1, StoP; 2, FoFF 400331 16H Addr (Address) 0, or run; 1, stoP; 2, FoFF <t< th=""><th></th><th></th><th>128+1=129, read-in MV or relevant parameter value</th><th></th></t<>			128+1=129, read-in MV or relevant parameter value	
actually, if dPt value is 1, and actual display is 100.0; this parameter could be written in, but soludin' t add 128, the range for self written in is 0-3. 40014 0DH Sct(Signal scale low limit) Unit same as MV 40015 0EH Sct(Signal scale high limit) Unit same as MV 40016 0FH ALP(Alarm selection) Ouput selection) Refer to manual 40017 10H OPL(Output tow limit) % 40019 40019 12H OPL(Output tow limit) % 40021 40021 12H OPL(Output tow limit) % 40022 40018 12H OPL(Output tow limit) % 40021 40021 14H CF (Communication Innetion) Refer to manual 40021 15H Model Tagged word 5180(AL-518) or5187 (AL-518P) 40022 16H Adr(Address) 40027 40023 17H FLI (Ogital Filtering) 184/4 MV(Manual output value) 0, run; 1, StoP; 2, HoLd 40028 16H Adr(Inddress) 0, orth; 1, stoP; 2, FoFF 400301 11H			16 integer is 1000, And it is to be displayed as 10.0	
Image is a parameter could be written in, but shouldn' t add 128, the range for self written in is 0~3. 40014 ODH Sct.(Signal scale low limit) Unit same as MV 40015 0FH Sch (Signal scale high limit) Unit same as MV 40016 0FH ALP(Alarm ouput selection) Refer to manual 40016 10H ScTranslation Unit same as MV 40017 11H OP1(Main output type) 0, SSR; 1, rELy: 2, 0-20; 3, 4-20 40018 12H OP4(Output low limit) % 40020 14H CPC (Communication function) Refer to manual 40021 15H Model Tagged word 5180(AL-518) or5187 (AL-518P) 40023 17H FLIC (Digital Filtering) 40025 40025 18H Addr (Address) 40026 40026 19H Loc(Parameter Lock) 40026 40027 18H Sam (Stop' Run selection) 0, run; 1, StoP; 2, HoLd 40028 1CH CHYS Ontil same as MV 40030 1EH SSPL (Uow limit of SV) Unit same as MV 40033 </td <td></td> <td></td> <td>actually; If dPt value is 1, and actual display is 100.0;</td> <td></td>			actually; If dPt value is 1, and actual display is 100.0;	
128, the range for self written in is 0-3. 40014 0DH ScL(Signal scale Unit same as MV 40015 0FH ALP(Alarm ouput Refer to manual 40016 10H ScTranslation Unit same as MV 40017 10H SCTranslation Unit same as MV 40018 12H OPH(Output mint) % 40020 limit) Refer to manual 40021 12H OPH(Output mint) % 40022 14H CF Communication Refer to manual 40021 14H CF Communication Refer to manual 40021 16H Addr (Address) 40022 40023 17H Filt (Digital Filtering) 40024 40024 18H* MAM(Manualaudo 0, RAN; 1, Auto; 2, FMAn; 3, FAut 40025 19H Loc/Parameter Lock) 40027 40028 1CH CHYS Control Unit same as MV 40031 1FH SPL (Low limit of SV) Unit same as MV 40031			this parameter could be written in, but shouldn't add	
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OEH Sch (Signal scale high lmit) Unit same as MV 40015 0FH ALP(Alarn selection) Refer to manual 40016 10H SC(Translation correct) Unit same as MV 40017 11H OP1(Main output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40018 12H OP4(Output low limit) % 40020 13H OP4(Output low limit) % 40021 13H OP4(Output low limit) % 40021 14H CF (Communication function) Refer to manual 40022 16H Addr (Address) 40023 40024 17H FLI (Digital Filtering) 40024 40027 18H* Addr (Manual auto selection) 0, run; 1, StoP; 2, HoLd 40028 19H Loc(Parameter Lock) 1.01 is ame as MV 40028 12H PAL(tow limit of SV) Unit same as MV 40028 12H SPH (Low limit of SV) Unit same as MV 40031 1FH SPH (Upper limit of SV) Unit same as MV 40032 <t< td=""><td>0DH</td><td>ScL(Signal scale low limit)</td><td>Unit same as MV</td><td>40014</td></t<>	0DH	ScL(Signal scale low limit)	Unit same as MV	40014
0FH ALP(Alarm ouput Refer to manual 40016 10H Sc(Translation correct) Unit same as MV 40017 11H OPI(Main output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40018 12H OPI(Output low limit) % 40020 13H OPI(Output high limit) % 40021 14H CF (Communication function) Refer to manual function) 40022 15H Model Tagged word 5180(AI-518) or5187 (AI-518P) 40022 16H Addr (Address) 40024 440024 18H** MAMArn(Manual/auto selection) 0, MAN; 1, Auto; 2, FMAn; 3, FAut 40025 19H Loc(Parameter Lock) 1 40027 40023 1AH** MV(Manual output value) 0, OFF; 1, on; 2; FOFF 40030 40029 1DH At (Auto tuning) 0, OFF; 1, on; 2; FOFF 40031 40032 1FH SPL (Low limit of SV) Unit same as MV 40032 40032 2DH Fru(unit and power frugency) 0, SGC; 1, 50F; 2, 60C; 3, 60F 40033	0EH	ScH (Signal scale high limit)	Unit same as MV	40015
10H Sc(Translation correct) Unit same as MV 40017 11H OP1(Main output type) 0. SSR: 1, rELy; 2, 0-20; 3, 4-20 40018 12H OP1(Output low limit) % 40020 13H OP1(Output high limit) % 40021 14H CF (Communication function) Refer to manual function) 40022 16H Addr (Address) 40023 17H FILt (Digital Filtering) 40024 18H** MAMAn(Manual/auto selection) 0, MAN; 1, Auto; 2, FMAn; 3, FAut 40025 19H Loc(Parameter Lock) 40027 40027 18H* MAMAn(Manual/auto selection) 0, run; 1, StoP; 2, HoLd 40028 1CH CHYS (Control Hystersis) Unit same as MV 40030 1EH SPL (Low limit of SV) Unit same as MV 40031 1FH SPL (Low limit of SV) Unit same as MV 40032 2DH At (Autio turing) 0, OFF; 1, on; 2; FoFF 40033 1FH SPL (Low limit of SV) Unit same as MV 40032 2DH<	0FH	ALP(Alarm ouput selection)	Refer to manual	40016
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14H CF (Communication function) Refer to manual 40021 15H Model Tagged word 5180(AI-518) or5187 (AI-518P) 40022 16H Addr (Address) 40023 17H FILI (Digital Filtering) 40024 18H** AMAn(Manualauto selection) 0. MAN; 1. Auto; 2. FMAn; 3, FAut 40025 19H Loc(Parameter Lock) 40027 40027 18H** MV(Manual output value) 40027 40028 1CH CHYS (Control Hystersis) 0, run; 1, StoP; 2, HoLd 40029 1DH At (Auto tuning) 0, OFF; 1, on; 2; FoFF 40030 1EH SPL (Low limit of SV) Unit same as MV 40022 2DH Fru (Upper limit of SV) Unit same as MV 40033 2H OHEF OPH((Work range of OPH)) Unit same as MV 40034 2H Act (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40035 2H Act (Acting method) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 Vpe) Vpe 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40	13H	OPH(Output high limit)	%	40020
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16H Addr (Address) 40023 17H Filt (Digital Filtering) 40024 18H** AMAn(Manual/auto selection) 0, MAN; 1, Auto; 2, FMAn; 3, FAut 40025 19H Loc(Parameter Lock) 40026 40026 1AH** MV(Manual output value) 40027 40027 1BH Srun (Stop/ Run selection) 0, run; 1, StoP; 2, HoLd 40029 1PH Atf Auto truing) 0, OFF; 1, on; 2; FoFF 40030 1DH At (Auto truing) 0, OFF; 1, on; 2; FoFF 40031 1FH SPH (Upper limit of SV) Unit same as MV 40032 20H Fru(Unit and power frequency) 0, SC; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH(Work range of OPH)) 0, rE; 1, on 40035 23H Act (Acting method) 0, rE; 1, on 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40038 26H 12 (Refrigerating	15H	Model Tagged word	5180(AI-518) or 5187 (AI-518P)	40022
17H FiLt (Digital Filtering) 40024 18H** AMAn(Manual/auto 0, MAN; 1, Auto; 2, FMAn; 3, FAut 40025 19H Loc(Parameter Lock) 40026 1AH** MV(Manual output value) 40027 1BH Srun (Stop/ Run output value) 40028 1CH CHYS (Control Hysteresis) Unit same as MV 40030 1DH At (Auto tuning) 0, OFF; 1, on; 2; FOFF 40030 1EH SPL (Low limit of SV) Unit same as MV 40032 20H Fru(Upper limit of Unit same as MV 40033 1FH SPL (Upper limit of Unit same as MV 40032 20H Fru(Upit and power 0, 50C; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH((Work range of OPH)) Unit same as MV 40034 22H Act (Acting method) 0, FF; 1, on; 2, rEbA; 3, drbA 40035 23H Adl (Alarm display) 0, OFF; 1, on 40036 24H Aut (Actic figreating output proportional band) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H	16H	Addr (Address)		40023
18H** AMAn(Manual/auto selection) 0, MAN; 1, Auto; 2, FMAn; 3, FAut 40025 19H Loc(Parameter Lock) 40026 1AH** MV(Manual output value) 40027 1BH Srun (Stop/ Run selection) 0, run; 1, StoP; 2, HoLd 40028 1CH CHYS (Control Hysteresis) 0, OFF; 1, on; 2; FoFF 40030 1EH SPL (Low limit of SV) Unit same as MV 40032 20H Fru(Unit and power frequency) 0, SOC; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH() Unit same as MV 40035 23H AdIs (Alarm display) 0, OFF; 1, on 2, rEbA; 3, drbA 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) Unit same as MV 40038 26H 12 (Refrigerating output Time of Derivative) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 28H Ct12 (Refrigerating output Time of Derivative) 0, onE; 1, ruSt; 2, SP1.2; 3, Pid2 40040 28H Ct12 (Refrigerating output Time of Derivative) 0, onE; 1, ruSt; 2, SP	17H	FILt (Digital Filtering)		40024
19H Loc(Parameter Lock) 40026 1AH** MV(Manual output value) 40027 1BH Srun (Stop/ Run selection) 0, run; 1, StoP; 2, HoLd 40028 1CH CHYS (Control Hysteresis) 0, OFF; 1, on; 2; FoFF 40030 1DH At (Auto tuning) 0, OFF; 1, on; 2; FoFF 40030 40032 1EH SPL (Low limit of SV) Unit same as MV 40032 40032 20H Fru(Unit and power frequency) 0, SOC; 1, 50F; 2, 60C; 3, 60F 40033 40034 21H OHEF OPH(Work range of OPH) Unit same as MV 40034 40035 23H AdIS (Alarm display) 0, OFF; 1, on 40036 40037 24H Act (Acting method) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) Unit same as MV 40038 26H 12 (Refrigerating output Time of integral) Seconds 40040 27H d2 (Refrigerating output Time of Derivative) 0.1s 40041 28H	18H**	AMAn(Manual/auto	0, MAN; 1, Auto; 2, FMAn; 3, FAut	40025
1AH** MV(Manual value) 40027 1BH Srun (Stop/ Run selection) 0, run; 1, StoP; 2, HoLd 40028 1CH CHYS (Control Hysteresis) 40029 1DH At (Auto tuning) 0, OFF; 1, on; 2; FoFF 40030 1EH SPL (Low limit of SV) Unit same as MV 40031 1FH SPH (Upper limit of VUput provide) 0, 50C; 1, 50F; 2, 60C; 3, 60F 40033 20H Fru(Unit and power frequency) 0, 50C; 1, 50F; 2, 60C; 3, 60F 40034 21H OHEF OPH()Work range of OPH) Unit same as MV 40035 23H Adt (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40036 24H Aut (Auxiliary output type) 0, OFF; 1, on 40036 25H P2 (Refrigerating output proportional band) seconds 40039 26H 12 (Refrigerating output proportional band) seconds 40040 27H d2 (Refrigerating output period) 0, nonE; 1, ruSt; 2, SP1.2; 3, PId2 40042 28H Cli2 (Refrigerating output period) 0, onnE	19H	Loc(Parameter Lock)		40026
value)value1BHSrun (Stop/ Run Sum (Stop/ Run Belection)0, run; 1, StoP; 2, HoLd400281CHCHYS (Control Hysteresis)Unit same as MV400291DHAt (Auto tuning)0, OFF; 1, on; 2; FoFF400301EHSPL (Low limit of SV) SV)Unit same as MV4003120HFru(Unit and power frequency)0, 50C; 1, 50F; 2, 60C; 3, 60F4003321HOHEF OPH((Work range of OPH))0, rE; 1, dr; 2, rEbA; 3, drbA4003422HAct (Acting method) vtpe)0, rE; 1, dr; 2, rEbA; 3, drbA4003523HAdlS (Alarm display) output proportional band)0, SSR; 1, rELy; 2, 0-20; 3, 4-204003725HP2 (Refrigerating output proportional band)Seconds4003926H12 (Refrigerating output Time of Derivative)0.1s4004027Hd2 (Refrigerating output Time of Derivative)0.1s4004129HEt (Event input type)0.1s4004129HEt (Event input type)0, nonE; 1, ruSt; 2, SP1.2; 3, PId2 type)4004320HPAF (Peargerating output type0, cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd type4004520H*PAF (Porgarm step IntegerInteger40046	1AH**	MV(Manual output		40027
1BH Srun (Stop/ Run selection) 0, run; 1, StoP; 2, HoLd 40028 1CH CHYS (Control Hysteresis) Unit same as MV 40029 1DH At (Auto tuning) 0, OFF; 1, on; 2; FoFF 40030 1EH SPL (Low limit of SV) Unit same as MV 40031 1FH SPH (Upper limit of V) Unit same as MV 40032 20H Fru(Unit and power frequency) 0, 50C; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH((Work Unit same as MV 40034 40034 range of OPH)) 0, OFF; 1, on 40036 22H Act (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40036 23H AdIS (Alarm display) 0, OFF; 1, on 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) seconds 40038 26H I2 (Refrigerating output Time of Derivative) seconds 40040 27H d2 (Refrigerating output type) 0.1s 40041 29H Et (Event input type) <td< td=""><td></td><td>value)</td><td></td><td></td></td<>		value)		
1CH CHYS (Control Hysteresis) Unit same as MV 40029 1DH At (Auto tuning) 0, OFF; 1, on; 2; FOFF 40030 1EH SPL (Low limit of SV) Unit same as MV 40031 1FH SPH (Upper limit of SV) Unit same as MV 40032 20H Fru(Unit and power frequency) 0, 50C; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH((Work range of OPH)) Unit same as MV 40034 22H Act (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40035 23H AdIS (Alarm display) 0, OFF; 1, on 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) seconds 40038 26H 12 (Refrigerating output Time of Derivative) 0.1s 40040 28H Ct12 (Refrigerating output period) 0, nonE; 1, ruSt; 2, SP1.2; 3, PId2 40042 28H* Ct12 (Refrigerating output period) 0, nonE; 1, ruSt; 2, SP1.2; 3, PId2 40042 2BH*	1BH	Srun (Stop/ Run selection)	0, run; 1, StoP; 2, HoLd	40028
1DH At (Auto tuning) 0, OFF; 1, on; 2; FoFF 40030 1EH SPL (Low limit of SV) Unit same as MV 40031 1FH SPH (Upper limit of SV) Unit same as MV 40032 20H Fru(Unit and power frequency) 0, 50C; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH((Work range of OPH)) Unit same as MV 40034 22H Act (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40035 23H AdlS (Alarm display) 0, OFF; 1, on 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) Unit same as MV 40038 26H I2 (Refrigerating output Time of Integral) Seconds 40039 27H d2 (Refrigerating output Time of Derivative) 0.1s 40040 28H Ctl2 (Refrigerating output period) 0.1s 40041 29H Et (Event input type) 0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2 40042 2AH**** SPr (Heating rate limit) Measuring unit/ (seconds)	1CH	CHYS (Control Hysteresis)	Unit same as MV	40029
1EHSPL (Low limit of SV)Unit same as MV400311FHSPH (Upper limit of SV)Unit same as MV4003220HFru(Unit and power frequency)0, 50C; 1, 50F; 2, 60C; 3, 60F4003321HOHEFOPH((Work range of OPH))Unit same as MV4003422HAct (Acting method)0, rE; 1, dr; 2, rEbA; 3, drbA4003523HAdlS (Alarm display)0, OFF; 1, on4003624HAut (Auxiliary output type)0, SSR; 1, rELy; 2, 0-20; 3, 4-204003725HP2 output proportional band)Unit same as MV4003826H12 output Time of Integral)0.1s4004027Hd2 output Time of Derivative)0.1s4004128HCtl2 (Refrigerating output projod)0, nonE; 1, ruSt; 2, SP1.2; 3, PId24004229HEt (Event input type)Measuring unit/ (seconds)400432BH* Pno (Program number)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH* FunctionPAF (Parameter Functions refer to the manual Functions refer to the manual40046	1DH	At (Auto tuning)	0. OFF; 1. on; 2; FoFF	40030
1FH SPH (Upper limit of SV) Unit same as MV 40032 20H Fru(Unit and power frequency) 0, 50C; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH((Work range of OPH)) Unit same as MV 40034 22H Act (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40035 23H AdlS (Alarm display) 0, OFF; 1, on 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) Unit same as MV 40038 26H I2 (Refrigerating output Time of Derivative) 0.1s 40040 27H d2 (Refrigerating output Time of Derivative) 0.1s 40041 28H Ctl2 (Refrigerating output period) 0.1s 40042 29H Et Et Event input type) 0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2 40042 2AH*** SPr (Heating rate limit) Measuring unit/ (seconds) 40043 2BH* Pno (Program number) 0, Cont; 1, StoP; 2, run1; 3, dASt; 4	1EH	SPL (Low limit of SV)	Unit same as MV	40031
20H Fru(Unit and power frequency) 0, 50C; 1, 50F; 2, 60C; 3, 60F 40033 21H OHEF OPH((Work range of OPH)) Unit same as MV 40034 22H Act (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40035 23H AdlS (Alarm display) 0, OFF; 1, on 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) Unit same as MV 40038 26H 12 (Refrigerating output Time of Integral) seconds 40039 27H d2 (Refrigerating output priod) 0.1s 40040 28H Ctl2 (Refrigerating output period) 0.1s 40041 29H Et Et Event input limit) 0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2 40042 2BH* Pno (Program number) Integer 40044 2CH* PonP (Power on) 0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd 40045 2DH* PAF (Parameter Function) Functions refer to the manual function	1FH	SPH (Upper limit of SV)	Unit same as MV	40032
21H range of OPH)OHEF unit same as MV4003422HAct (Acting method)0, rE; 1, dr; 2, rEbA; 3, drbA4003523HAdlS (Alarm display)0, OFF; 1, on4003624HAut (Auxiliary output type)0, SSR; 1, rELy; 2, 0-20; 3, 4-204003725HP2 output proportional band)Unit same as MV4003826HI2 (Refrigerating output Time of Integral)Unit same as MV4003927Hd2 (Refrigerating output Time of Derivative)0.1s4004028HCtl2 (Refrigerating output period)0.1s4004129HEt (Event input type)0. nonE; 1, ruSt; 2, SP1.2; 3, PId24004228H* Immer SPr (Heating umber)Measuring unit/ (seconds) Immer 0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452BH* PAF PAF PAF (Parameter Function)Integer400462EH*STEP (Program step IntegerInteger40047	20H	Fru(Unit and power frequency)	0, 50C; 1, 50F; 2, 60C; 3, 60F	40033
22H Act (Acting method) 0, rE; 1, dr; 2, rEbA; 3, drbA 40035 23H AdlS (Alarm display) 0, OFF; 1, on 40036 24H Aut (Auxiliary output type) 0, SSR; 1, rELy; 2, 0-20; 3, 4-20 40037 25H P2 (Refrigerating output proportional band) Unit same as MV 40038 26H I2 (Refrigerating output Time of Integral) seconds 40039 27H d2 (Refrigerating output Time of Derivative) 0.1s 40040 28H Ctl2 (Refrigerating output period) 0.1s 40041 29H Et (Event input type) 0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2 40042 28H* Otl2 (Refrigerating output period) 0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2 40043 2BH* Pno (Program number) Integer 40043 2BH* PonP (Power on) 0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd 40045 2DH* PAF (Parameter Functions refer to the manual 40046 2H* STEP (Program step Integer 40046	21H	OHEF OPH((Work range of OPH))	Unit same as MV	40034
23HAdlS (Alarm display)0, OFF; 1, on4003624HAut (Auxiliary output type)0, SSR; 1, rELy; 2, 0-20; 3, 4-204003725HP2 output proportional band)Unit same as MV4003826HI2 output Time of Integral)Seconds4003927Hd2 output Time of Derivative)0.1s4004028HCtl2 output period)0.1s4004129HEt (Event input type)0, nonE; 1, ruSt; 2, SP1.2; 3, Pld24004228H*SPr (Heating rate limit)Measuring unit/ (seconds)400432BH*Pno number)Integer400442CH*PonP (Power on) PAF (Parameter Function)0, cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452EH*STEP (Program step IntegerInteger40046	22H	Act (Acting method)	0, rE; 1, dr; 2, rEbA; 3, drbA	40035
24HAut (Auxiliary output type)0, SSR; 1, rELy; 2, 0-20; 3, 4-204003725HP2 output proportional band)Unit same as MV4003826HI2 (Refrigerating output Time of Integral)Seconds4003927Hd2 output Time of Derivative)0.1s4004028HCtI2 (Refrigerating output period)0.1s4004129HEt t (Event input type)0, nonE; 1, ruSt; 2, SP1.2; 3, PId24004228H*Pno (Program number)(Records)400432BH*Pno (Program number)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*STEP (Program step IntegerFunctions refer to the manual 4004640046	23H	AdIS (Alarm display)	0, OFF; 1, on	40036
25HP2 P2 (Refrigerating output proportional band)Unit same as MV4003826HI2 (Refrigerating output Time of Integral)seconds4003927Hd2 (Refrigerating output Time of Derivative)0.1s4004028HCtt2 (Refrigerating output period)0.1s4004129HEt (Event input type)0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2400422AH***SPr (Heating rate limit)Measuring unit/ (seconds)400432BH*Pno number)(Program Integer400442CH*PonP (Power on) PonP (Power on)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)Functions refer to the manual Function40047	24H	Aut (Auxiliary output	0, SSR; 1, rELy; 2, 0-20; 3, 4-20	40037
26HI2 (Refrigerating output Time of Integral)seconds4003927Hd2 (Refrigerating output Time of Derivative)0.1s4004028HCtl2 (Refrigerating output period)0.1s4004129HEt type)Et (Event input limit)0, nonE; 1, ruSt; 2, SP1.2; 3, Pld24004228H*Pno (Program number)0, cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452EH*STEP (Program step IntegerInteger40047	25H	P2 (Refrigerating output proportional band)	Unit same as MV	40038
Integral)0.1s27Hd2(Refrigerating output Time of Derivative)0.1s4004028HCtl2(Refrigerating output period)0.1s4004129HEt(Event input type)0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2400422AH***SPr (Heating rate limit)Measuring unit/ (seconds)400432BH*Pno number)(Program Integer1nteger2CH*PonP (Power on)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)Functions refer to the manual400462EH*STEP (Program step IntegerInteger40047	26H	I2 (Refrigerating output Time of	seconds	40039
27Hd2(Refrigerating output Derivative)0.1s4004028HCtl2(Refrigerating output period)0.1s4004129HEt(Event input type)0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2400422AH***SPr(Heating limit)Measuring unit/ (seconds)400432BH*Pno number)(Program linteger400442CH*PonP (Power on)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)Functions refer to the manual400462EH*STEP (Program step IntegerInteger40047		Integral)		
28HCtl2 output period)(Refrigerating output period)0.1s4004129HEt type)Event input output period)0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2400422AH***SPr (Heating rate limit)Measuring unit/ (seconds)400432BH*Pno number)(Program number)Integer400442CH*PonP (Power on) PAF Function)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)(Parameter Functions refer to the manual400462EH*STEP (Program step IntegerInteger40047	27H	d2 (Refrigerating output Time of Derivative)	0.1s	40040
29HEt(Event input type)0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2400422AH***SPr(Heating rate limit)Measuring unit/ (seconds)400432BH*Pno number)(Program linteger400442CH*PonP (Power on)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)(Parameter Functions refer to the manual400462EH*STEP (Program step 	28H	Ctl2 (Refrigerating	0.1s	40041
2AH***SPr (Heating rate limit)Measuring unit/ (seconds)400432BH*Pno number)(Program Integer400442CH*PonP (Power on)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)(Parameter Functions refer to the manual400462EH*STEP (Program step IntegerInteger40047	29H	Et (Event input	0, nonE; 1, ruSt; 2, SP1.2; 3, Pld2	40042
2BH* Pno (Program Integer 40044 number) 0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd 40045 2CH* PonP (Power on) 0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd 40045 2DH* PAF (Parameter Functions refer to the manual Function) 40046 2EH* STEP (Program step Integer 40047	2AH***	SPr (Heating rate	Measuring unit/ (seconds)	40043
2CH*PonP (Power on)0, Cont; 1, StoP; 2, run1; 3, dASt; 4, HoLd400452DH*PAF Function)(Parameter Functions refer to the manual400462EH*STEP (Program step IntegerInteger40047	2BH*	Pno (Program	Integer	40044
2DH* PAF (Parameter Functions refer to the manual Function) 40046 2EH* STEP (Program step Integer 40047	2CH*	PonP (Power on)	0. Cont: 1. StoP: 2. run1: 3. dASt: 4. Hold	40045
2EH* STEP (Program step Integer 40047	2DH*	PAF (Parameter	Functions refer to the manual	40046
	2EH*	STEP (Program step	Integer	40047

	number)		
2FH*	Run time	0.1m or0.1h, decided by PAF parameter	40048
30H*	Event input status	0, none; 1, Event 1 (AL1) action; 2, AL2 action;	40049
		3, AL1and AL2 action	
31H**	OPrt(soft start time)		40050
32H**	Strt(Valve start time)	Defines the time needed for valve start.	40051
33H**	SPSL (External setpoint low limit)	When external set point input port is used for measuring valve feedback signal, set the valve position value as 1.	40052
34H**	SPSH(External setpoint upper limit)	When external set point input port is used for measuring valve feedback signal, set the valve position value as 2.	40053
35H**	Ero(Error output value)	Defines regulation output value, when sensor input default or super range.	40054
36H**	AF2	Function parameter 2	40055
37H~3 ⊑⊔	Standby		40056~4006
40H~47	ED1~ED8		40065~4007
H H			2
48H**	Valve position (for read only)	0~25600 is equal to 0~100% (0~100% is the measuring value divided by 256)	40073
49H~4 FH	Standby		40074~4008 0
50H~51 H	SP 1、t 1	SP1 SV 1, t1 first segment program value	40081~
52H~	SP2 ~ program segment value , defined by Pno parameter		

NOTE:

1, Parameters with * mark is just for AI-518P/708P/719P, and they' re invalid parameter code for AI-518/708/719, Parameters with **mark are for AI-719, and parameters with***mark is only for AI-518P/708P/719/719.

2、 If read parameters outside above list(invalid parameter code or standby parameter code), then the instrument returns the value as 127 for high-value (if read integer, which is 32512~32767, because maximum set range is 32000, parameter beyond 32512 means the mark for mis-reading parameter code.), and is to be processed in the computer program; if parameter code read is larger than last value of valid program segment(0B4H), then it's regarded as wrong as well, and no response.

***When using MODBUS protocol communication, if reading SV to be 40001, it requires reading 4 records at a time. Suppose instrument address number to be 1, then dispatching data should be 01 03 00 00 00 04 CRC (40001, 40002, 40003, 40004)

Return the data as :01 03 08 PV (40001) SV (40002) MV and CRC which is the parameter (40004: PS here mean the record of SV) read from Alarm Status (40003)

Upper Alarm: 01H (40002)

Then dispatching the record 01 03 00 02 00 04 CRC (read 40002、40003、40004、40005 to get 4 records)

Return the record as 01 03 08 PV (40002) SV (40003) MV and CRC which is the parameter (40005: PS here mean the record of HIAL) read from Alarm Status (40004).

3. Instruments with manual operation function can support regulating output value manually by writing 1AH parameter.

4, 15H is model tagged word for instruments, different tagged word for different model instruments.

		Tagged word
A	NI-518(V8.0)	5180

AI-518P(V8.0)	5187
AI-708(V8.0)	7080
AI-708P(V8.0)	7087
AI-719(V8.0)	7190
AI-719P(V8.0)	7197
AI-702M/704M/706M	768
AI-708H/808H	256 (for accumulate only); 257 (for batch
	control mode)
AI-808H	258
AI-301M	512
AI-7048	7048

3 Programme

System uses the master-slave multi-machine communication structure, each directive to the instrument, then instrument returns a data. When writing computer software, please be noted that the instrument must make response to each valid directive within 0~150ms, and you should not send new directive until the instrument responses to last directive, or it may cause default. If the response time longer than 150ms, it mean the directive may be invalid, or communication line default etc. At that time, computer should resend the directive or just change the address of instrument. For example, set the SV (parameter code is 0)of the instrument (address 1) to be 100.0°C (Integer is 1000), then program with VB:

Initialize communication port, including baud rate which same as instrument, data bit 8, stop bit
without verifying.

2、VB program command (set SP1as 1000): COMM1.OUTPUT=

CHR\$(129)+CHR\$(129)+CHR\$(67)+CHR\$(0)+CHR\$(232)+CHR\$(3)+CHR\$(44)+CHR\$(4)

3, Radix point process just for V8.0): To enhance efficiency, all values instrument transfers are 16bit two's complement integer. So computer should convert integer into actual data with decimal point. The method is when PC starts, priority should be put to read parameter dPt 0CH) to obtain the decimal point position of measuring signal. Note: if dPt value larger than or equal to 128, MV and parameter with same unit as MV should be displayed after divided by 10, when writing this parameter, the value showed should be converted to integer, multiplied by 10, and be downloaded with 16-bit two's complement.

Technical specification for communication :

Model	AI-301、AI-7/8 series	AI-5 series
Latest response time	100mS	150mS
(under 4800bit/S condition)		
Fastest response time	5mS	5mS
(under 19200 bit/S condition)		
Average read-write period	20mS	50mS
(under 19200bit/S condition)		
Allowed parameter modification	1 billion	1 million
frequency		

NOTE: For AI-5XX series instruments, writing time for parameter is better to longer than 2 seconds, or it may cause default of storage unit during 5 year warranty period.

4 MODBUS Communication protocol

From V8.2, Modbus communication protocol could be available for AI series controllers., AI controllers can support 2 subcommands under Modbus protocol, to intercommunictate widely with other Modbus equipment. For keeping the rate, AI controllers adopt RTU(Binary system) mode, baud rate should be set as 9600bit/S, no parity, support two directives of 03H (for reading parameter and record) \gtrsim 06H (write single record.).

As per 03 directive for 518/708/708P/719/719P controller, it requires reading 4 records at a time, directives as follows :

ADDR+03H+0+parameter code to be read+0+4+CRC check code

Return the record to be : ADDR+03H+08H+ PV high order position+ PV low order + SV high order position +SV low order + Alarm status+ MV+ parameter value high order position + parameter value low order +CRC check code low order +CRC check code high order position

Write single parameter directive to be :

ADDR+06H+0+parameter code to be written+ record high order position to be written + record low order position to be written +CRC check code