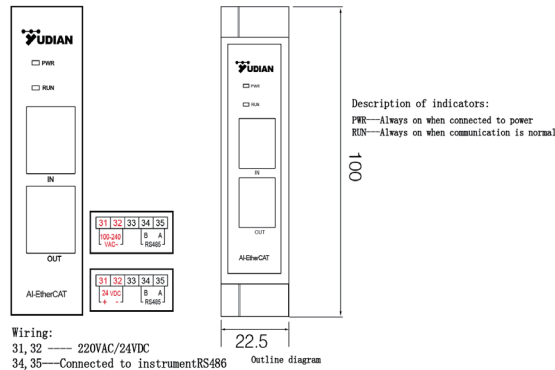




Version	Content modified	Date
V1.0	Change to the ID number of the release version	May-18-2023
V0.2	Modify status, 00-stop, 01- run	Feb-10-2023
V0.3	Add manual / automatic mode (V9.21)	Mar-3-2023
V0.4	1. Add host disconnection protection 2.Adjust manual and AT cancellation tag numbers	Apr-3-2023
V0.5	Change the manual automatic status to bit5	Apr-10-2023
V1.0	Change to the ID number of the release version	May-18-2023
V1.1.1	Added support for 8-channel temperature control instruments	Nov-10-2023

2.Appearance and wiring



3.Summary

The AI EtherCAT converter V1.0 is compatible with the conventional one-channel meter and four-channel controlling instruments such as 7048/7248/7648 supported by the MODBUS RTU protocol in the V9 version of Yudian's AI series temperature-controlling instruments.

When connecting to the AI EtherCAT converter, the above temperature-controlling instrument needs to be set to standard MODBUS RTU mode.

The parameter range for one-channel instrument (v9.0 and above versions) is set from 1 to 8 for Addr, 19200 for Baud, and 0 for AFC.

Set the Addr of 4-channel temperature controller such as 7*48 to 1 and 5, and set the Baud parameter to 19200. The H bit of the AF parameter (v9.05 and above versions) is set to 1 (decimal 128), or the version with AFC (v9.21 and above) switches AFC to MODBUS by setting it to 0.

Set the Addr of 8-channel instruments such as 8*88 to 1 or 9, and set the Baud parameter to 19200. The H bit of the AF parameter (v9.05 and above versions) is set to 1 (decimal 128), or the version with AFC (v9.21 and above) switches AFC to MODBUS by setting it to 0.

The 8-channel meter needs to set the instrument tag to 111, as shown in 5.3; If it is necessary to switch to a 4-channel meter or a one-channel meter after connecting an 8-channel instrument, the instrument tag should be set to 000 first.

4. Input mapping

4.1 Overview of Input Data

Index	Subindex	I/O product name	Type	Initial value	Notes
0x6000	1	Ch1 Operating Status	UINT16	0	Ch1~8 operating status, details can be found in 4.2, 4.3, and 4.4
	2	Ch2 Operating Status	UINT16	0	
	3	Ch3 Operating Status	UINT16	0	
	4	Ch4 Operating Status	UINT16	0	
	5	Ch5 Operating Status	UINT16	0	
	6	Ch6 Operating Status	UINT16	0	
	7	Ch7 Operating Status	UINT16	0	
	8	Ch8 Operating Status	UINT16	0	
0x6001	1	Ch1 Process Data	INT16	0	Ch1-8 PV value, default unit is 0.1 ℃ , which can be set on the instrument, please refer to the manual for details.
	2	Ch2 Process Data	INT16	0	
	3	Ch3 Process Data	INT16	0	
	4	Ch4 Process Data	INT16	0	
	5	Ch5 Process Data	INT16	0	
	6	Ch6 Process Data	INT16	0	
	7	Ch7 Process Data	INT16	0	
	8	Ch8 Process Data	INT16	0	
0x6002	1	Ch1 MV Monitor	INT16	0	Ch1~8 output percentage (MV)
	2	Ch2 MV Monitor	INT16	0	
	3	Ch3 MV Monitor	INT16	0	
	4	Ch4 MV Monitor	INT16	0	
	5	Ch5 MV Monitor	INT16	0	
	6	Ch6 MV Monitor	INT16	0	
	7	Ch7 MV Monitor	INT16	0	
	8	Ch8 MV Monitor	INT16	0	
0x6003	1	Ch1 Output and Alarm Status	INT16	0	Ch1-8 output and alarm status, details can be found in 4.4, 4.5, 4.6
	2	Ch2 Output and Alarm Status	INT16	0	
	3	Ch3 Output and Alarm Status	INT16	0	
	4	Ch4 Output and Alarm Status	INT16	0	
	5	Ch5 Output and Alarm Status	INT16	0	
	6	Ch6 Output and Alarm Status	INT16	0	
	7	Ch7 Output and Alarm Status	INT16	0	
	8	Ch8 Output and Alarm Status	INT16	0	
0x6004	1	Ch1 Proportional Band Monitor	INT16	0	Ch1~8 proportional band monitoring, with the same unit as the measured value
	2	Ch2 Proportional Band Monitor	INT16	0	
	3	Ch3 Proportional Band Monitor	INT16	0	
	4	Ch4 Proportional Band Monitor	INT16	0	
	5	Ch5 Proportional Band Monitor	INT16	0	
	6	Ch6 Proportional Band Monitor	INT16	0	
	7	Ch7 Proportional Band Monitor	INT16	0	
	8	Ch8 Proportional Band Monitor	INT16	0	

0x6005	1	Ch1 Integration Time Monitor	INT16	0	Ch1-8 Integration time monitoring, measured in seconds
	2	Ch2 Integration Time Monitor	INT16	0	
	3	Ch3 Integration Time Monitor	INT16	0	
	4	Ch4 Integration Time Monitor	INT16	0	
	5	Ch5 Integration Time Monitor	INT16	0	
	6	Ch6 Integration Time Monitor	INT16	0	
	7	Ch7 Integration Time Monitor	INT16	0	
	8	Ch8 Integration Time Monitor	INT16	0	
0x6006	1	Ch1 Derivative Time Monitor	INT16	0	Ch1-8 differential time monitoring, unit: 0.1 seconds
	2	Ch2 Derivative Time Monitor	INT16	0	
	3	Ch3 Derivative Time Monitor	INT16	0	
	4	Ch4 Derivative Time Monitor	INT16	0	
	5	Ch5 Derivative Time Monitor	INT16	0	
	6	Ch6 Derivative Time Monitor	INT16	0	
	7	Ch7 Derivative Time Monitor	INT16	0	
	8	Ch8 Derivative Time Monitor	INT16	0	

4.2 Operating status of single channel temperature control instrument

Name	Bit	Description
ON/OFF status	bit0	00: Stop; 01: Run; 1X: hold
	bit1	
AT	bit2	0: stop ; 1: run
Reserved	bit3	Reserved
Channel status	bit4	0: offline; 1: online
M/Auto status	bit5	0: Automatic; 1: Manual
Host disconnection protection	Bit6	0: disabled; 1: enabled. After enabled, the channel device shall stop running if EtherCAT connection fails, enabled by default
bit7~11	Bit7~11	Reserved
Instrument markings	bit12~14	000: default; 001: one-channel instrument; 100: 4-channel instrument; 111: 8-channel instrument
Channel polling status	bit15	0: polling; 1: not polling

4.3 Operating status of 7*48 series

Name	Bit	Description
ON/OFF status	bit0	00: Stop; 01: Run
	bit1	Reserved
AT	bit2	0: stop ; 1: run
Reserved	bit3	Reserved
Channel status	bit4	0: offline; 1: online
M/Auto status	bit5	0: Automatic; 1: Manual
Host disconnection protection	bit6	0: disabled; 1: enabled. After enabled, the channel device shall stop running if EtherCAT connection fails, enabled by default
bit7~11	bit7~11	Reserved
Instrument markings	bit12~14	000: default; 001: one-channel instrument; 100: 4-channel instrument; 111: 8-channel instrument
Channel polling status	bit15	0: polling; 1: not polling

Note: The 7*48 manual and automatic are only supported in the running status, that is, when in the stopping status, there is no distinction between manual and automatic.

4.4 Operating status of 8*88 series

Name	Bit	Description
ON/OFF status	bit0	00: Stop; 01: Run
	bit1	Reserved
AT	bit2	0: stop ; 1: run
Reserved	bit3	Reserved
Channel status	bit4	0: offline; 1: online
M/Auto status	bit5	0: Automatic; 1: Manual
Host disconnection protection	bit6	0: disabled; 1: enabled. After enabled, the channel device shall stop running if EtherCAT connection fails, enabled by default
bit7~11	bit7~11	Reserved
8-channel instrument markings	bit12~14	000: default; 001: one-channel instrument; 100: 4-channel instrument; 111: 8-channel instrument
Channel polling status	bit15	0: polling; 1: not polling

4.5 Output and alarm status of one-channel temperature-controlling instrument

Name	Bit	Remark	Description
HIAL	Bit0	Upper limit alarm	0: No alarm; 1: Alarm
LOAL	Bit1	Lower limit alarm	0: No alarm; 1: Alarm
HDAL	Bit2	Upper limit deviation alarm	0: No alarm; 1: Alarm
LDAL	Bit3	Lower limit deviation alarm	0: No alarm; 1: Alarm
ORAL	Bit4	Over-range alarm	0: No alarm; 1: Alarm
AL1	Bit5	Output AL1	0: OFF ; 1: ON
AL2	Bit6	Output AL2	0: OFF ; 1: ON
Bit7	Bit7	Reserved	
OP1	Bit8	Output OP1	0: OFF ; 1: ON
OP2	Bit9	Output OP2	0: OFF ; 1: ON
AU1	Bit10	Output AU1	0: OFF ; 1: ON
AU2	Bit11	Output AU2	0: OFF ; 1: ON
MIO	Bit12	Output MIO	0: OFF ; 1: ON
Bit13~15	Bit13~bit15	Reserved	

4.6 Output and alarm status of 7*48 series

The models of the four-channel temperature-controlling instruments supported by V1.0 are 7048, 7248, and 7648.

Name	Bit	Remark	Description
HIAL	Bit0	Upper limit alarm	0: No alarm; 1: Alarm
LOAL	Bit1	Lower limit alarm	0: No alarm; 1: Alarm
Bit2~3	Bit2	Reserved	
ORAL	Bit4	Over-range alarm	0: No alarm; 1: Alarm
AL1*1	Bit5	Output AL1	0: OFF; 1: ON
AL2*1	Bit6	Output AL2	0: OFF; 1: ON
Bit7	Bit7	Reserved	
OP1	Bit8	Output OP1	0: OFF; 1: ON
Bit9~15	Bit9~bit15	Reserved	

4.7 Output and Alarm Status of 8*88 series

Name	Bit	Remark	Description
Bit0	Bit0	Reserved	
HIAL	Bit1	Upper limit alarm	0: No alarm; 1: Alarm
LOAL	Bit2	Lower limit alarm	0: No alarm; 1: Alarm
HDAL	Bit3	Upper limit deviation alarm	0: No alarm; 1: Alarm
LDAL	Bit4	Lower limit deviation alarm	0: No alarm; 1: Alarm
Bit5~15	Bit5~15	Reserved	

5.Output mapping

index	Subindex	I/O product name	Type	Initial value	Notes
0x7000	1	Ch1 Operation Command	UINT16	0	Ch1~8 operating status, details can be found in 5.1and 5.2
	2	Ch2 Operation Command	UINT16	0	
	3	Ch3 Operation Command	UINT16	0	
	4	Ch4 Operation Command	UINT16	0	
	5	Ch5 Operation Command	UINT16	0	
	6	Ch6 Operation Command	UINT16	0	
	7	Ch7 Operation Command	UINT16	0	
	8	Ch8 Operation Command	UINT16	0	
0x7001	1	Ch1 Set Value	INT16	0	Ch1-8 SV value, in the same units as PV
	2	Ch2 Set Value	INT16	0	
	3	Ch3 Set Value	INT16	0	
	4	Ch4 Set Value	INT16	0	
	5	Ch5 Set Value	INT16	0	
	6	Ch6 Set Value	INT16	0	
	7	Ch7 Set Value	INT16	0	
	8	Ch8 Set Value	INT16	0	
0x7002	1	Ch1 PV Input Shift	INT16	0	Ch1~8 SCB value
	2	Ch2 PV Input Shift	INT16	0	
	3	Ch3 PV Input Shift	INT16	0	
	4	Ch4 PV Input Shift	INT16	0	
	5	Ch5 PV Input Shift	INT16	0	
	6	Ch6 PV Input Shift	INT16	0	
	7	Ch7 PV Input Shift	INT16	0	
	8	Ch8 PV Input Shift	INT16	0	
0x7003	1	Ch1 Manual MV	INT16	0	Manual value(MV), in the same units as PV
	2	Ch2 Manual MV	INT16	0	
	3	Ch3 Manual MV	INT16	0	
	4	Ch4 Manual MV	INT16	0	
	5	Ch5Manual MV	INT16	0	
	6	Ch6 Manual MV	INT16	0	
	7	Ch7 Manual MV	INT16	0	
	8	Ch8 Manual MV	INT16	0	

0x7005	1	Ch1 Proportional Band	INT16	0	Ch1-8 proportional band, in the same units as PV
	2	Ch2 Proportional Band	INT16	0	
	3	Ch3 Proportional Band	INT16	0	
	4	Ch4 Proportional Band	INT16	0	
	5	Ch5 Proportional Band	INT16	0	
	6	Ch6 Proportional Band	INT16	0	
	7	Ch7 Proportional Band	INT16	0	
	8	Ch8 Proportional Band	INT16	0	
0x7006	1	Ch1 Integration Time	INT16	0	Ch1-8 integration time, in seconds
	2	Ch2 Integration Time	INT16	0	
	3	Ch3 Integration Time	INT16	0	
	4	Ch4 Integration Time	INT16	0	
	5	Ch5 Integration Time	INT16	0	
	6	Ch6 Integration Time	INT16	0	
	7	Ch7 Integration Time	INT16	0	
	8	Ch8 Integration Time	INT16	0	
0x7007	1	Ch1 Derivative Time	INT16	0	Ch1-8 differential time, in units of 0.1 seconds
	2	Ch2 Derivative Time	INT16	0	
	3	Ch3 Derivative Time	INT16	0	
	4	Ch4 Derivative Time	INT16	0	
	5	Ch5 Derivative Time	INT16	0	
	6	Ch6 Derivative Time	INT16	0	
	7	Ch7 Derivative Time	INT16	0	
	8	Ch8 Derivative Time	INT16	0	
0x7008	1	Ch1 Alarm Value Upper Limit	INT16	0	Ch1~8 upper limit alarm, in the same unit as PV
	2	Ch2 Alarm Value Upper Limit	INT16	0	
	3	Ch3Alarm Value Upper Limit	INT16	0	
	4	Ch4 Alarm Value Upper Limit	INT16	0	
	5	Ch5 Alarm Value Upper Limit	INT16	0	
	6	Ch6 Alarm Value Upper Limit	INT16	0	
	7	Ch7 Alarm Value Upper Limit	INT16	0	
	8	Ch8 Alarm Value Upper Limit	INT16	0	
0x7009	1	Ch1 Alarm Value Lower Limit	INT16	0	Ch1~8 lower limit alarm, in the same unit as PV
	2	Ch2 Alarm Value Lower Limit	INT16	0	
	3	Ch3 Alarm Value Lower Limit	INT16	0	
	4	Ch4 Alarm Value Lower Limit	INT16	0	
	5	Ch5 Alarm Value Lower Limit	INT16	0	
	6	Ch6 Alarm Value Lower Limit	INT16	0	
	7	Ch7 Alarm Value Lower Limit	INT16	0	
	8	Ch8 Alarm Value Lower Limit	INT16	0	

5.1 Operation command of one-channel temperature-controlling instrument

Name	Bit	Description
ON/OFF status	Bit0	00: Stop; 01: Run; 1X: hold
	Bit1	
AT run	Bit2	0→1, AT run; Effective rising edge
Reserved	Reserved	
AT cancellation	Bit4	0→1, AT cancel; Effective rising edge
M/Auto	Bit5	Level, 0: automatic; 1: Manual
Host disconnection protection	bit6	0: disabled; 1: enabled. After enabled, the channel device shall stop running if EtherCAT connection fails, enabled by default
Bit7~11	Bit7~11	Reserved
Instrument markings	bit12~14	000: default; 001: one-channel instrument; 100: 4-channel instrument; 111: 8-channel instrument
Channel polling status	bit15	0: polling; 1: not polling

Note 1: When writing a command, the initial value of the corresponding bit is 0. Only when a change is detected in this bit, will it be written to the temperature control instrument. Different positions do not affect each other.

5.2 Operation Command of 7*48 series

Name	Bit	Testing method	Description
ON/OFF status	Bit0	Level	00: Stop; 01: Run
	Bit1		Reserved
AT run	Bit2	Edge (rising edge)	0→1, AT run; Effective rising edge
Reserved	Reserved		Reserved
AT cancellation	Bit4	Edge (rising edge)	0→1, AT cancel; Effective rising edge
M/Auto	Bit5	Level	0: automatic; 1: Manual
Host disconnection protection	bit6	Level	0: disabled; 1: enabled. After enabled, the channel device shall stop running if EtherCAT connection fails, enabled by default
Bit7~11	Bit7~11	Reserved	Bit7~11
8-channel instrument markings	bit12~14	Level	000: default; 001: one-channel instrument; 100: 4-channel instrument; 111: 8-channel instrument
Channel polling status	bit15	Level	0: polling; 1: not polling

Note 1: The 7*48 manual and automatic are only supported in the running status, that is, when in the stopping status, there is no distinction between manual and automatic. Note 2: When writing a command, the initial value of the corresponding bit is 0. Only when a change is detected in this bit, will it be written to the temperature control instrument. Different positions do not affect each other. Note 3: When writing a command, the channel polling status only takes effect at the starting address of the instrument (i.e. 1, 5, 9, or 13).

5.3 Operation command of 8*88 series

Name	Bit	Testing method	Description
ON/OFF status	Bit0	Level	00: Stop; 01: Run
	Bit1		Reserved
AT run	Bit2	Edge (rising edge)	0→1, AT run; Effective rising edge
Reserved	Reserved		Reserved
AT cancellation	Bit4	Edge (rising edge)	0→1, AT cancel; Effective rising edge
M/Auto	Bit5	Level	0: automatic; 1: Manual
Host disconnection protection	bit6	Level	0: disabled; 1: enabled. After enabled, the channel device shall stop running if EtherCAT connection fails, enabled by default
Bit7~11	Bit7~11	Reserved	Bit7~11
8-channel instrument markings	bit12~14	Level	000: default; 001: one-channel instrument; 100: 4-channel instrument; 111: 8-channel instrument
Channel polling setting	bit15	Level	0: polling; 1: not polling

Note 1: The 8*88 manual and automatic are only supported in the running status, that is, when in the stopping status, there is no distinction between manual and automatic. Note 2: When writing a command, the initial value of the corresponding bit is 0. Only when a change is detected in this bit, will it be written to the temperature control instrument. Different positions do not affect each other. Note 3: When writing a command, the channel polling status only takes effect at the starting address of the instrument (i.e. 1 or 9). Note 4: When writing a command, the 8-channel instrument markings must be set and only take effect at the starting address of the instrument (i.e. 1 or 9).



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