

CH SERIES INSTRUCTION MANUAL

Before operating this instrument, please read this manual carefully and fully understand its contents.

WARNING

- If failure or error of this instrument could result in a critical accident of the system, install an external protection circuit to prevent such an accident.
- Do not turn on the power supply until all of the wiring is completed. Otherwise electric shock, fire or malfunction might result.
- Use this instrument within the scope of its specifications. Otherwise fire or malfunction might result.
- Do not use this instrument in the places subject to flammable or explosive gas.
- Do not touch high voltage blocks, such as power supply terminals. Otherwise electric shock may result.
- Never disassemble, repair or modify this instrument by yourself. This might cause malfunction.

◆ Main specifications

The CH series controller has the following principal characteristics:

- ✧ Independent process and set point displays.
- ✧ Universal input for thermocouple, RTD, Volt, and mA.
- ✧ RS485 opto-isolated serial interface with MODBUS/RTU protocol.
- ✧ PID control with auto tuning.
- ✧ Automatic/Manual operation.
- ✧ Initial preheating RAMP function.
- ✧ Power for two-wire transmitter.
- ✧ Opto-isolated digital input for second set point and other programmable functions.
- ✧ Settable OFF-SET for input signal.
- ✧ Main control output: relay, SSR logic or continuous Volt/mA.
- ✧ Selectable heating/cooling control.
- ✧ Max/min set points limitation by user.
- ✧ Selectable max output power to load.

◆ Order code

Please check whether the delivered product is as specified by referring to the following model code list. And please specify the model code when you place the order.

CH - *

Panel size

102	48×48mm
402	48×96mm
702	72×72mm
902	96×96mm
502	96×48mm
602	80×160mm
802	160×80mm

Control method

F	PID control (reverse action)
D	PID control (direct action)
W	Heating/cooling PID control

Universal input

Define factory setting of the Input/range
EX. K07 (thermocouple K input, range 0~1372℃)

OUTPUT 1

M	Relay output
V	SSR logic output
8	Voltage/mA continuous output
G	SCR zero-cross output
T	SCR phase-shift output

OUTPUT 2

Alarm 2 is active when control action is W

M	Relay output
V	SSR logic output
R	mA transmitting output
G	SCR zero-cross output

ALARM 1

N	NO ALARM 1
□	ALARM 1 active (Alarm code*)

ALARM 2

N	NO ALARM 2
□	ALARM 2 active (Alarm code*)

RS485 interface

N	NO RS 485 serial interface
C	RS 485 interface is active, MODBUS/RTU protocol

Power supply

7	100 to 240VAC
I	24 to 30Vac/dc

Ex: CH 102 F K02 M AB C 7

It's a controller with PID control Reverse action; dimension 48x48mm; input type K and range 0~400? ; relay output; two alarms with deviation high and low alarm mode; RS485 serial interface; and 110~220VAC power supply.

NOTE: IF YOU NEED OTHER OPTIONAL FUNCTIONS, SUCH AS AUTO/MANUAL SELECTION, IT SHOULD BE DEFINED IN THE ORDER.

◆ Technical features introduction

I. Inputs

Following inputs can be programmed in this instrument

✧ IEC 584 thermocouple

Input	Range Code	Range (?)	Reso.
K	01	0 ~ 200	0.1/1
	02	0 ~ 400	0.1/1
	03	0 ~ 600	0.1/1
	04	0 ~ 800	0.1/1
	05	0 ~ 1000	0.1/1
	06	0 ~ 1200	0.1/1
	07	0 ~ 1372	0.1/1
J	01	0 ~ 200	0.1/1
	02	0 ~ 400	0.1/1
	03	0 ~ 600	0.1/1
	04	0 ~ 800	0.1/1
	05	0 ~ 1000	0.1/1
R*	01	0 ~ 1600	0.1/1
	02	0 ~ 1769	0.1/1
S*	01	0 ~ 1600	0.1/1
	02	0 ~ 1769	0.1/1
B*	01	400 ~ 1820	0.1/1
	02	0 ~ 1820	0.1/1
E	01	0 ~ 800	0.1/1
	02	0 ~ 1000	0.1/1
N	01	0 ~ 1200	0.1/1
	02	0 ~ 1300	0.1/1
T	01	0.0 ~ 400.0	0.1/1
	02	0.0 ~ 100.0	0.1/1
	03	0.0 ~ 200.0	0.1/1
	04	0.0 ~ 350.0	0.1/1

✧ IEC 751 resistance temperature detector

Input	Range Code	Range (?)	Reso.
Pt100	01	-199.9~649.0	0.1
	02	-199.9~200.0	0.1
	05	-100.0~200.0	0.1
	08	0.0 ~ 200.0	0.1
Cu50	10	0.0 ~ 500.0	0.1
	01	-50 ~ 100.0	0.1
	02	-50 ~ 150.0	0.1
	03	-50 ~ 50.0	0.1
	04	0.0 ~ 50.0	0.1
	05	0.0 ~ 100.0	0.1
Order code C	06	0.0 ~ 150.0	0.1

✧ Linear signals

Input type	Code	Range	Resolution
Volt 0/1-5V*	V	-1999~9999	0.2%F.S.
mA 0/4-20mA	A	-1999~9999	0.2%F.S.

*With supplied external adapter, it could be 0/2-10V input, it should be defined in the order.

*Other special input type, should be specified in the order.

II. Main heating/cooling output

- ✧ Cycle time 1-100s
- ✧ Actuation
 - SPDT relay 5A@250V AC, 6A@125V AC
 - 0-12VDC logic, 35mA max load
 - Linear Voltage 0/1-5V
 - Linear Current 0/4-20mA

III. Alarms

- ✧ 2 relay alarms
 - SPDT relay 5A@250V AC

◇ **Alarm code*:**

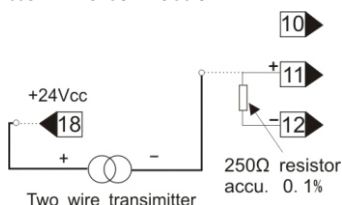
- A** deviation high alarm **B** deviation low alarm
- C** deviation high/low alarm **D** band alarm
- E** deviation high alarm with hold action
- F** deviation low alarm with hold action
- G** deviation high/low alarm with hold action
- H** process high alarm **J** process low alarm
- K** process high alarm with hold action
- L** process low alarm with hold action
- V** SV high alarm **W** SV low alarm

I. Serial interface (optional feature)

- ◇ MODBUS/RTU protocol
- ◇ Read/write all device programming parameters.
- ◇ Maximum devices on network: 128
- ◇ Blinking LED indicates RS485 serial interface running status.
- ◇ RS485 opto-isolated 2.5Kvolt.

II. supplementary power (optional feature)

- ◇ Power for a two-wire transmitter
- ◇ 24VDC max 35mA
- ◇ Short circuit protection
- ◇ Transmitter wire connection



III. Ramp function (optional feature)

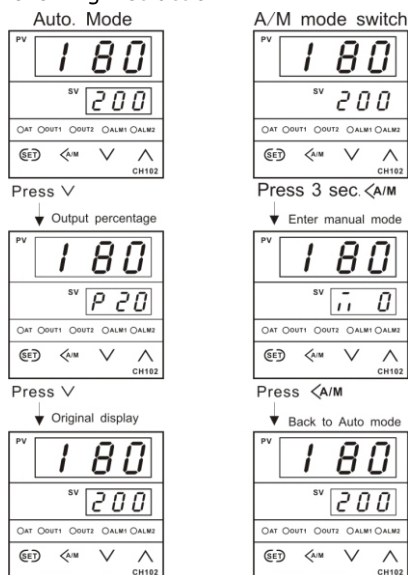
- ◇ Approach the RAMP set point in setting time.
- ◇ Blinking LED indicating RAMP active.
- ◇ RAMP mode options:
 - RAMP run as power on
 - RAMP run after programming parameters
 - Continuous RAMP mode
 - One-shot RAMP mode

IV. Digital input (optional feature)

- ◇ Opto-isolated 2.5Kvolt
- ◇ Programmable for: switching between two set points; auto/man switching; keypad lock.
- ◇ Potential free contact actuation.

V. A/m mode selection (optional feature)

- ◇ To check the output percentage on AUTO. Mode.
- ◇ To set the output percentage on MAN. Mode.
- ◇ The shift key on front panel makes it easy to switch between AUTO/MAN modes.
- ◇ See following instruction:



VI. Auto tuning (ATU) function

The ATU function automatically measures, computers and sets the optimum PID constants.

■ **Requirements for ATU start**

- ✓ Prior to starting the ATU function, end all the parameter settings other than PID.
- ✓ Confirm the LCK function has not been engaged.

■ **Requirements for ATU suspension**

- ✓ When the SV is changed.
- ✓ When the PV bias value is changed.
- ✓ When the sensor loop break.
- ✓ When P (proportional band) = 0
- ✓ When the instrument is on Manual mode.

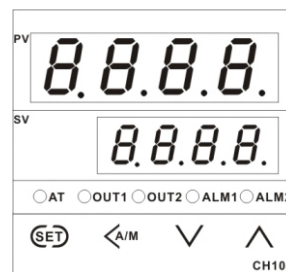
VII. Environment

- ◇ 0 ~ 50? ambient temperature
- ◇ 45 ~ 85% non-condensing humidity

VIII. Power supply

- ◇ 100~240VAC 50-60Hz
- Consumption: 4VA
- ◇ 21~30V AC/DC
- Consumption: 4VA

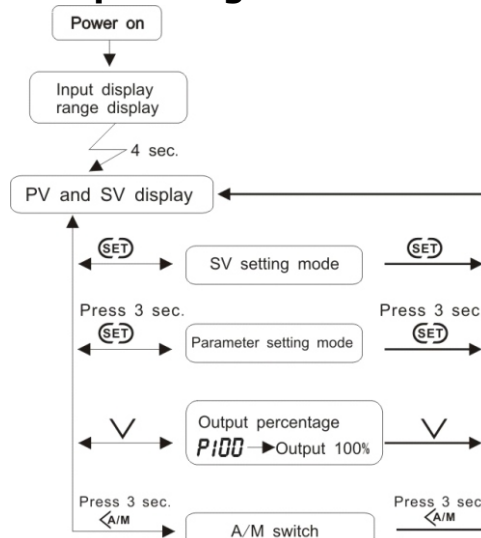
◆ **Description of the front panel**



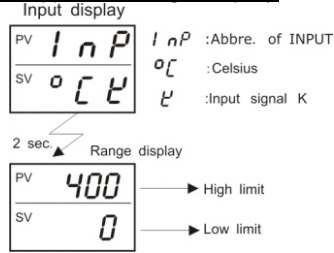
PV	Process value
SV	Setting value
AT	auto-tuning status
OUT1	Output 1 status
OUT2	Output 2 status
ALM1	ALM1 status
ALM2	ALM2 status
SET	Function key
<A/M	Shift key and auto/man mode selection
V ^	Down and up key for setting value

NOTE: When RS485 serial interface is available, then the "OUT2" lamp would be labeled as "SER". The front panel is different from different features.

◆ **Operating flow chart**



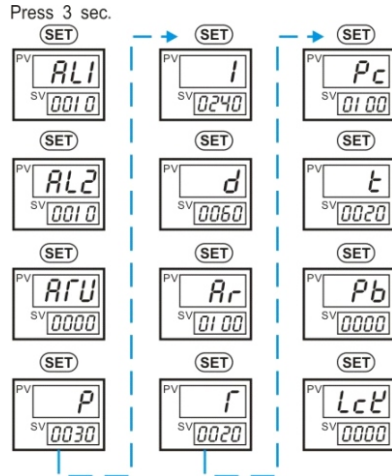
Layout of input type and range display



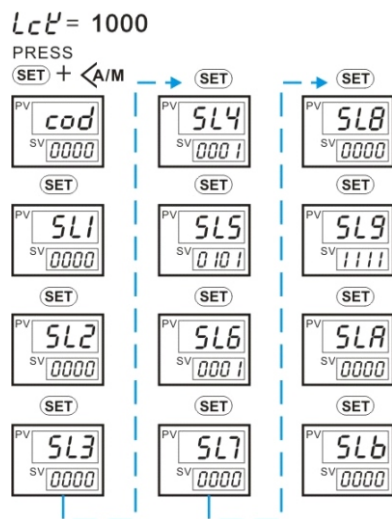
◆ Parameters menu

LEVEL ONE: PV and SV display mode (normal display)

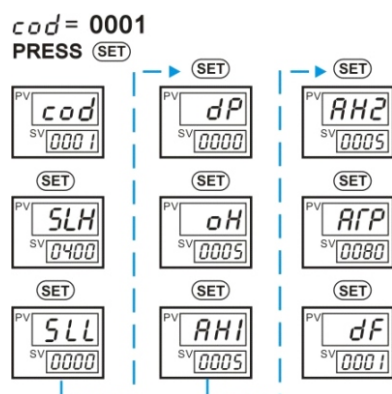
LEVEL TWO:



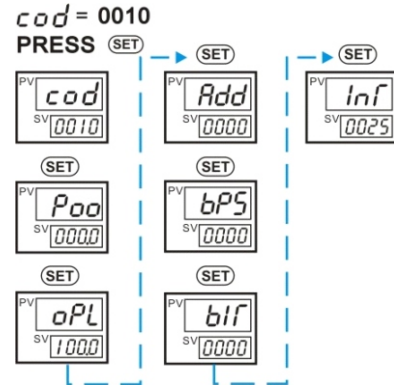
LEVEL THREE:



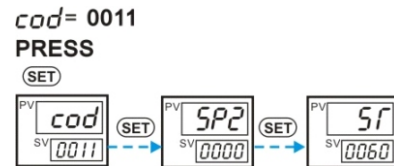
LEVEL FOUR:



LEVEL FIVE:



LEVEL SIX:



◆ Parameters description

Parameters in LEVEL TWO

AL1 alarm value of ALARM 1. Factory set value is 0010. This parameter is connected to the alarm mode parameter SL4.

Supposed the Alarm 1 mode is Deviation high alarm, AL1=10, then the alarm value would be 10 degrees higher than the set point. If AL1=0020, then alarm value should be 20 degrees higher than the set point.

In case the alarm mode is set as deviation low alarm, AL1=0010, then alarm value is 10? lower than set point.

AL2 alarm value of ALARM 2. Factory set value is 0010. It is concerned to the Alarm 2 mode parameter SL5. Function is same as AL1.

ARV auto tuning

0000 auto tuning inactive. (factory set value)

0001 auto tuning active.

NOTE: It can be used with ATP parameter which is for setting auto tuning start on percentage of set point.

P proportional band

Set when PI, PD or PID control is performed.

0000 no proportional band, ON/OFF control.

Setting range 0 to 9999(999.9)

Factory set value 0030

I integral time. Set the time of integral action which eliminates the offset occurring in proportional control.

0000 no integral time, PD control

Setting range 0 to 3600 sec.

Factory set value 0240

d differential time. Set the time of derivative action which prevents ripples by predicting output changes and thus improves control stability.

0000 no differential time, PI control.

Setting range 0 to 3600 sec.

Factory set value 0060.

Ar limitation of integral time

Setting range 0 to 100 Factory set value 0100

EX.: SV is 100? ; P=30; Ar=100%, when PV=70? , controller will enter proportional band

If, SV is 100? ; P=30; Ar=80%, then the controller will start integral action until PV=76? (set point 100? - Ar 80% x P30).

I proportioning cycle. Set control output cycle.
Setting range 1 to 100 sec. (0 can not be set)
Factory set value 0020

Pc proportional band for cooling action.
Setting range 1 to 1000%
Factory set value 0100 (100%)
If there is no OUT2 on hardware, this parameter will not display in the parameter menu.

t proportional cycle for cooling action.
Setting range is 1 to 100%; Factory set value 0002
Same as Pc, it will not display when there is no OUT2.

Pb offset of cold junction.
Setting range -1999 to +9999? (-199.9 to + 999.9)
Factory set value 0000

LcL Lock parameter (Factory set value 0000)

CODE	Details of lock levels
0000	SV and all parameters can be set
0001	Only SV and alarms can be set
0010	Only setting items other than alarms can be set
0011	Only SV can be set
0100	Only setting items other than SV can be set
0101	Only alarms can be set
0110	Only setting items other than SV and alarm can be set
0111	SV and parameter can not be set
1000	To enter cod level parameters

Parameters in LEVEL THREE

cod code for dividing different parameter levels.

0000 LEVEL THREE **0001** LEVEL FOUR
0010 LEVEL FIVE **0011** LEVEL SIX

SLI programming codes for different input signals
Factory set value 0000 (thermocouple type K)

Code	Input type	Code	Input type
0000	K	1000	Pt100/Pt1000
0001	J	1001	Cu50
0010	E		
0011	N	1010	0-5V
0100	R	1011	1-5V
0101	S	1100	0-20mA
0110	B	1101	4-20mA
0111	T		

NOTE: Pt100 and Pt1000 should be selected via a jumper.

SL2 code of engineering unit.
0000 Celsius **0001** Fahrenheit

SL3 reserved parameter.

SL4 alarm mode selection of ALARM 1

Code	Alarm mode
X 000	Alarm 1 is inactive
X 001	Deviation high alarm
X 010	Deviation high/low alarm
X 011	Process high alarm
X 101	Deviation low alarm
X 110	Band alarm
X 111	Process low alarm
0 XXX	NO hold action
1 XXX	With hold action

Factory set value 0001 (deviation high alarm).

SL5 alarm mode selection of ALARM 2
programming codes are same as SL4.
Factory set value 0101(deviation low alarm)

SL6 control output (Factory set value 0001)

Code	Corresponding features
XXX 0	Direct control action (D)
XXX 1	Reverse control action (F)
XX 0 X	4-20mA output
XX 1 X	0-20mA output
X 0 XX	mA output selection is off
X 1 XX	mA output selection is on
0 XXX	No OUT2
1 XXX	OUT2 active(relay or SSR output only)

SL7 relay mode (alarm relay) (Factory set value 0000)

Code	Corresponding features
XXX 0	Trigger NO – NC on alarm 1
XXX 1	Trigger NC – NO on alarm 1
XX 0 X	Trigger NO – NC on alarm 2
XX 1 X	Trigger NC – NO on alarm 2

SL8 optional features code (Factory set value 0000)

Code	Corresponding features
XX 0 X	Auto/Man mode selection off
XX 1 X	Auto/Man mode selection on
X 0 XX	RS485 interface off
X 1 XX	RS485 interface on
0 XXX	Output memory on Man mode is off
1 XXX	Output memory on Man mode is on

SL9 alarm for exceeding high /low input scale.

Code	Corresponding features
XXX 0	Alarm 1, "PV" exceed alarm off
XXX 1	Alarm 1, "PV" exceed alarm on
XX 0 X	Alarm 1, "PV" low limit alarm
XX 1 X	Alarm 1, "PV" high limit alarm
X 0 XX	Alarm 2, "PV" exceed alarm off
X 1 XX	Alarm 2, "PV" exceed alarm on
0 XXX	Alarm 2, "PV" low limit alarm
1 XXX	Alarm 2, "PV" high limit alarm

Factory set value 1111* (see display at error occurrence)

SLA optional features selection

0000 no limitation to any features

0001 enable SV and SP2 switch

0010 switch to Manual mode as external contact closed (digital input contact closed).

0011 keyboard enabled(digital input contact open)
Key board disabled(digital input contact closed).

Factory set value 0000

SLb RAMP set point (Factory set value 0000)

Code	RAMP features
0 XXX	RAMP function is off
1 XXX	RAMP function is on
X 0 XX	RAMP will not run as power on
X 1 XX	RAMP will run as power on
XX 0 X	One shot RAMP mode
XX 1 X	Continuous RAMP mode
XXX 0	RAMP will not run when user change SV
XXX 1	RAMP will run when user change SV

Parameters in LEVEL FOUR

SLH high point of measurement range

EX. The input it type K, and range is 0-400? , then set SLH=400. If you want range is 0-1000? , then set SLH=1000.

Setting range depends on the input sensor signal. Please see 3.1 Inputs introduction.

Factory set value 0400

SLL low point of measurement range
To define the low range, usually the value is 0
Factory set value 0000

dP decimal point
Following parameters can be set decimal points
PV, SV, SP2, P, SLH, SLL, AL1, AL2, AH1, AH2, Pb, and oH.
Factory set value 0000

oH dead band of control output (ON/OFF control)
EX. Supposed SV=100? , oH=5? , when PV=100,
controller would stop heating, when the temperature is
95? , it will start heating, because the dead band is 5? .
Factory set value 0005

AH1 AL2 dead band of ALARM 1 and ALARM 2
Factory set value 0005

ATP Auto tuning start on percentage of set point
Setting range 0 to 100 Factory set value 0080 (80%)
EX. Supposed SV is 100? , and ATP is 80%, then auto
tuning would be in action based on 80? (ATP80% x SV
100?).

dF filter the bias of PV
0000 filter off 0001 filter on
Factory set value 0001

Parameters in LEVEL FIVE

Poo offset on PID control output
Setting range 0 to 100.0% Factory set value 000.0

oPL output power limit percentage on Auto/Man mode
Setting range 0 to 100.0% Factory set value 100.0

Add slave code on MODBUS protocol
Setting range 1 to 255 Factory set value 0000

bPS communication speed BAUD RATE
0000 2400bps **0001** 4800bps
0002 9600bps **0003** 19200bps

bif digit structure on communication

Code	Bit	Checking bit	Stop bit
0	8	None	1
1	8	Odd	1
2	8	Even	1

InF delay time on communication
Setting range 0 to 2000ms Factory set value 0000

Parameters in LEVEL SIX

SP2 the second set point. It can be switched to SV via
digit input external contact.
Setting range SPL to SPH
Factory set value 0020

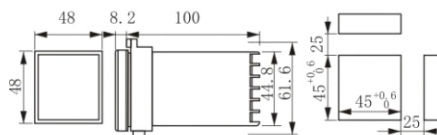
SR RAMP time
RAMP set point run in the time scale.
Setting range 0 to 900 min.
Factory set value 0060 (60min.)

◆ Display at error occurrence

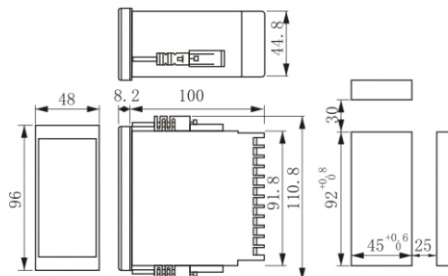
Symbol	Error occurrence
0000 (Flashing)	Over scale Measured value(PV) exceeds the high input display range limit or sensor crash
UUUU (Flashing)	Under scale Measured value(PV) exceeds the low input display range limit or sensor crash

◆ Dimensions

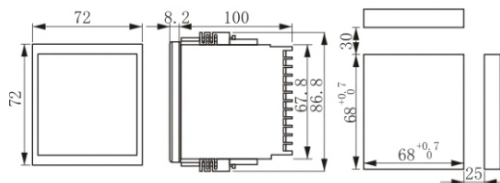
CH 102



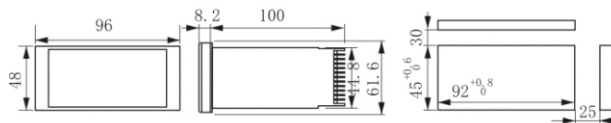
CH 402



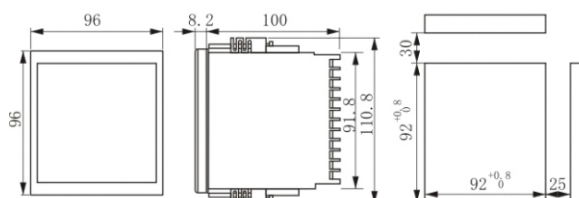
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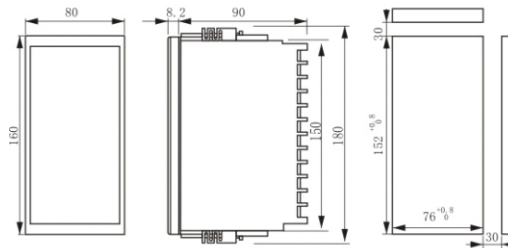
CH 502



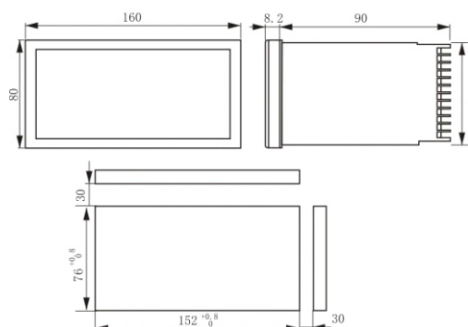
CH 902



CH 602



CH 802



◆ Wire connection

CH 102

1	13	7
2	14	8
3	15	9
4	16	10
5	17	11
6	18	12

Terminal	Content	Terminal	Content	Terminal	Content
1	AC 100~240V	13	→SG	7	Alarm 2
2	AC 24V	14	→T/R(A)	8	Alarm 1
3	DC 24V	15	→T/R(B)	9	COM
4	OUT1	16	Dig. Input	10	Input signal
5	OUT2	17	→+24Vcc	11	
6		18	24Vcc	12	

CH 702

1	10
2	11
3	12
4	13
5	14
6	15
7	16
8	17
9	18

Terminal	Content	Terminal	Content
1	AC 100~240V	10	Alarm 2
2	AC 24V	11	Alarm 1
3	DC 24V	12	COM
4	OUT1	13	→+24Vcc
5	OUT2	14	Dig. Input
6		15	Dig. Input
7	→SG	16	Input signal
8	→T/R(A)	17	
9	→T/R(B)	18	

CH 902

1	13
2	14
3	15
4	16
5	17
6	18
7	19
8	20
9	21
10	22
11	23
12	24

CH 402

1	13
2	14
3	15
4	16
5	17
6	18
7	19
8	20
9	21
10	22
11	23
12	24

CH 502

12	11	10	9	8	7	6	5	4	3	2	1
24	23	22	21	20	19	18	17	16	15	14	13

Terminal	Content	Terminal	Content
1	AC 100~240V	13	→SG
2	AC 24V	14	→T/R(A)
3	DC 24V	15	→T/R(B)
4	OUT1	16	Dig. Input
5	OUT2	17	Dig. Input
6		18	→+24Vcc
7	Alarm 2	19	
8	Alarm 1	20	
9	COM	21	
10	Input signal	22	
11		23	
12		24	

*Note: CH 602 and CH 802 wire connection are reversed.

Appendix

- Instruction manual
- Mounting bracket
- 250Ω resistor with 0.1% accuracy (only with mA input controller)

Distributors

