Electronic Expansion Valve Controller

FX32EV

USER MANUAL

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INNOBIZ

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1. OVERVIEW

※ FEATURES

- Superheat Control by PID
- PWM(Pulse Width Modulation) and Valve Open Ratio Control
- Analog Signal Output(4-20mA)

: STANDARD SPECIFICATIONS

Model	Description
Dimensions	87(W)mm X 30(H)mm X 114(D)mm
Power	100 – 240 Vac, 50 / 60 Hz
Power Consumption	MAX 6 VA
Display	FND, LED (0.1°C Display)
Connection	Screw Terminal(1.5 ㎟ Wire Compatible)
Input	Temperature Sensor 1P / Pressure Sensor 1P
Output	Expansion Valve On/Off 1P Relay Output 1P (250 Vac / 30 Vdc / 5 A)
Operation	Temperature –10~50°C, Humidity 90%RH or less
Storage	Temperature –20~60 °C, Humidity 90%RH or less

: SELECTION GUIDE

Model	Description
FX32EV-00	Standard
FX32EV -A1 *	4 ~ 20 mA Transmission
FX32EV –R4 *	RS485 Communication : MODBUS RTU MODE

※ Temperature sensor is optional.
* Communication Cable Included

: ACCESSSORIES

Model	Description	
DPR-PT1K-P4D50L*3m	Type	Pt 1000 Ω
	Range	-100 – 100 °C
	Accuracy	± 0.3 °C
	50mm 3meter Dia. 4.0	
DP506.930A DP506.931A DP506.933A	Power	DC12V~24V
	Signal Output	4~20mA 2Wire
	Protection Degree	IP65
	Accuracy	±0.25%
	Operating temp.	–40 to 120°C
	Range	930A : -1 – 9 bar
		931A : -1 – 15 bar
		933A : 0 – 30 bar
	Connection	1(+V), 2(out)

2. INSTALLATION

: DIMENSIONS AND PANEL CUT(mm)
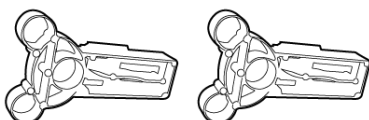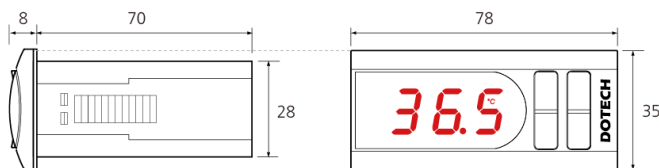
bracket 2ea

DOTECH Standardized Dimensions (Panel Cut Size : 71 X 29mm)

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: WIRING DIAGRAM
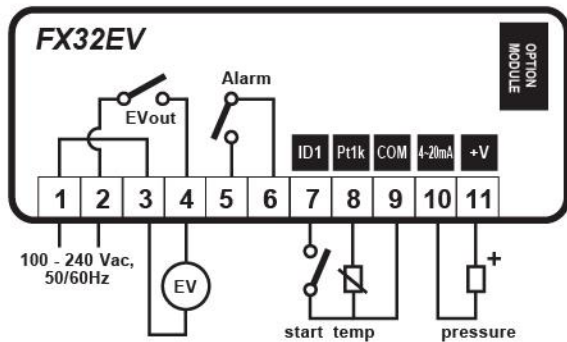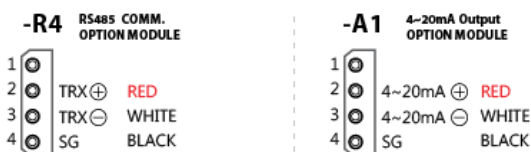
: Terminal

No.	Definition	Description
1	POWER	100~240 Vac, 50/60Hz Power Input
2		
3	EV out	Electronic expansion valve control ON/OFF output
4		
5	Alarm	Aux. relay(RL1) output, Normal close signal
6		Aux. relay (RL1) common output
7	ID1	Run/Stop signal input
8	Pt1K	Temperature sensor
9	COM	Signal common
10	4-20mA	Pressure sensor input
11	+V	Power for pressure sensor : Dc12v output

: OPTION MODULE

: Command of Run / Stop

If ID1 is short circuited (ON), it will start to run. In case of opening (OFF), operation will be stopped and expansion valve is closed immediately.

: Utilization of auxiliary relay (RL1)

Auxiliary relay can be used for alarm or compressor ON/OFF or liquid valve ON/OFF.
In case of Pd= Off, use it as an alarm purpose.
In case of Pd= SOL, use it as a control output of liquid valve ON/OFF.
 If users enter pumpdown time (1~180 sec), it will be used for ON/OFF signal of compressor.

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3.   User interface

: Display & keypad

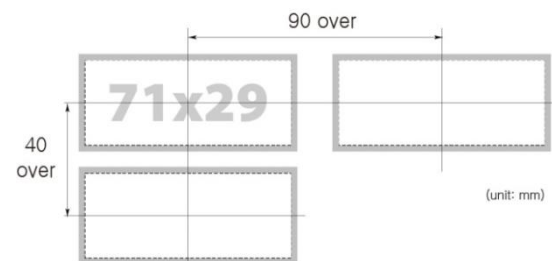| Definition	Description
LED	
Ev	Lighting when Expansion valve is ON
SH	Lighting when Superheat is displayed.
T	Lighting when Temperature is displayed.
P	Lighting when pressure is displayed.
℃ , bar	**℃ :** Temperature / **bar** : pressure
⚠	Lighting when warning (Flickering when manual return alarm occurs)
🔧	Flickering at manual open ratio control
Button	
PRG	Parameter change mode
SEL	Select and save
▲	Increase or upward, Confirm expansion valve control output
▼	Decrease or downward
PRG ▼	Reset when Pressed Simultaneously for 10 Seconds.

: COMMUNICATIONS SPECIFICATIONS (-R4 Model)

Definition	Description
Transmission line connection	Multiple line
Communications method	RS485 (2-wire, half-duplex)
Baud-rate	BPS default 4800 BPS
Parity, Data, Stop bit	None, 8 Data, 1 Stop
Protocol Type	Modbus RTU MODE
Function Code	Read HOLD REGISTERS (0x03) Preset Single Register (0x06)
Maximum Read Word	32 Word
Media Type	BELDEN 9841 / 9842, LG LIREV-AMESB
Poll interval	100msec

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4.   Parameters

: SET VALUE SETTINGS

```
                    ┌──────────────┐
                    │  Operation   │◄──────────┐
                    │    Mode      │           │
                    └──────────────┘           │
                           │                   │
                     ┌───┐ Press for 5         │
                     │PRG│   seconds           │
                     └───┘                      │
                      PARAMETER                 │
                      SETTINGS                   │
                         │                      │
                         ▼                      │
                    ◇ PASSWORD ◇                │
                         │                      │
                         ▼                      │
    ┌──────────┐    ┌──────────┐  ▲▼  ┌──────────┐
    │   Menu   │    │   Menu   │◄──►  │   Menu   │
    └──────────┘    └──────────┘      └──────────┘
                  SEL↓  ↑PRG        SEL↓  ↑PRG
    ┌──────────┐  ┌──────────┐      ┌──────────┐
    │Parameter │  │Parameter │      │Parameter │
    │   •      │  │   •      │      │   •      │
SEL │   •      │SEL│  •      │   SEL│   •      │
    │   •      │  │   •      │      │   •      │
    │Parameter │  │Parameter │      │Parameter │
    │   END    │  │   END    │      │   END    │
    └──────────┘  └──────────┘      └──────────┘
                      │                  │
                    ┌───┐ Press for 3  ┌───┐ Press for 3
                    │SEL│   seconds    │SEL│   seconds
                    └───┘              └───┘
```
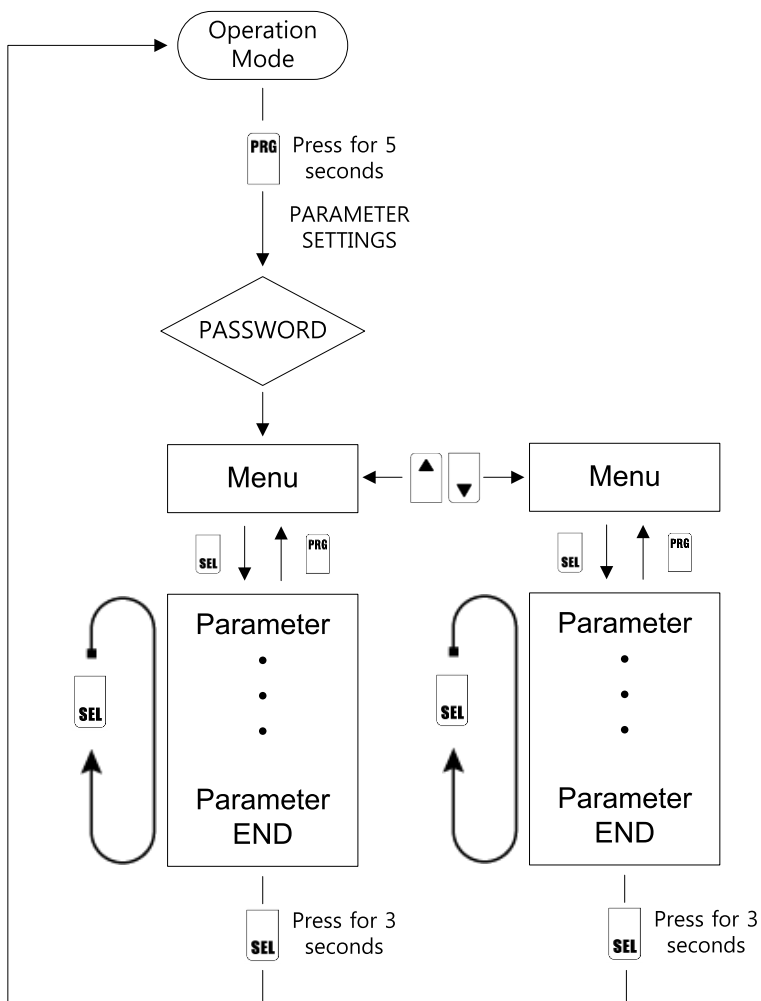
● Press and hold PRG button for more than 5 seconds to change parameters.
※ **It is necessary to input password to change parameters.**
(If password is not correct, it is impossible to change parameters.)
● Press SEL button to move to the next menu or save set point during parameters settings.
● The set point is indicated by flickering at every 0.5 seconds intervals and this set point can be set (changed) by using the ▲ key or ▼ key.
● Present value will be displayed if users press SEL button for 3 seconds after change of set point
● If there is no input for 3 minutes during setup, it returns to operation mode.
● It will be returned to first thing on the menu if users press PRG button during menu settings.

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: PARAMETER TABLE IN GROUP 1 (*l .Pr*)

Address	Function	Code	Unit	Step	Min.	Max.	Default	Custom
4 0001	Superheat set-point	*SH*	K	0.1	0.5	30.0	6.0	
4 0003	Start open ratio	*blr*	%	1	0	100	50	
4 0004	Start open ratio duration time (※1)	*Sdt*	second	1	0	600	5	
4 0005	P: Proportional band (※2)	*dFr*	%	0.1	0.1	100.0	3.0	
4 0006	I: Integral time (※3)	*Irt*	second	1	0	999	120	
4 0007	D: Derivative time	*drt*	second	1	0	999	0	
4 0008	Low superheat alarm mode (※4)	*LS*	*0*= Not in use	*1* = Automatic return	*2*= Manual return		*1*	
4 0009	Detect low superheat alarm	*LSH*	K	0.1	0.5	30.0	0.5	
4 0010	Low superheat alarm delay time	*LSd*	second	1	1	60	1	
4 0011	Clear low superheat alarm	*LSF*	K	0.1	1.0	30.5	3.0	
4 0012	Max. operating pressure alarm mode (※5)	*ṁP*	*0*= Not in use	*1* = Automatic return	*2*= Manual return		*1*	
4 0013	MOP alarm detection pressure	*ṁoP*	barg	0.1	-1.0	50.0	9.0	
4 0014	MOP alarm detection delay time	*ṁPd*	minute	1	0	15	1	
4 0015	MOP alarm clearance pressure	*ṁPF*	Barg	0.1	-1.0	8.9	8.0	
4 0016	High superheat alarm mode	*HS*	*0*= Not in use	*1* = Automatic return	*2*= Manual return		*0*	
4 0017	Detect high superheat alarm (※6)	*HSH*	K	1	10	40	30	
4 0018	High superheat alarm delay time	*HSd*	second	1	1	60	3	
4 0019	Clear high superheat alarm	*HSF*	K	1	7	37	27	
4 0021	Freezing protection alarm mod	*Fr*	*0*= Not in use	*1* = Automatic return	*2*= Manual return		*0*	
4 0022	Detect freezing protection alarm (※7)	*FrE*	℃	1	-100	40	0	
4 0023	Freezing protection alarm delay time	*Frd*	second	1	5	200	30	
4 0024	Clear freezing protection alarm	*FrF*	℃	1	3	43	3	
4 0025	Select pumpdown function and delay time (※8) (setup use purpose of auxiliary relay output)	*Pd*	second	1	*oFF*(-1)	180	*oFF*	
4 0026	Pumpdown finish pressure	*PdP*	barg	0.1	-0.5	18.0	0.5	
4 0027	Pressure low limit alarm mode	*LP*	*0*= Not in use	*1* = Automatic return	*2*= Manual return		*0*	
4 0028	Detect low limit pressure alarm (※9)	*LoP*	barg	0.1	-0.8	17.7	0.0	
4 0029	Low limit pressure alarm delay time	*LPd*	second	1	5	200	5	
4 0030	Clear low limit pressure alarm	*LPF*	barg	0.1	0.3	18.0	0.3	

(※1) Start open ratio and start open ration duration time

If switch of ID1 is turned on, valve will be opened by start open ratio. After that maintain it during start open ratio duration time and start to control.
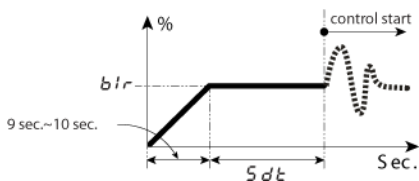
(※2) Setup proportional gains

Proportional gain makes a decision on control input of valve open ration according to superheat change.

If proportional gain is 3.0%, control input of valve open ration is 3.0% per 1.0K of superheat.

If change of valve open ration is fickle, decrease proportional gain.

If change of valve open ration is slow, increase proportional gain more.

Valve open ratio [%] = Start open ratio + (proportional gain X tolerance)

(※3) Integral time and derivative time

Integral time: Input time which is applied to control for accumulated volume of tolerance.

Derivative time: It is for control momentary reacting volume for tolerance, basically set it to '0'.

If vibration time is longer than integral time
1. Integral time increases 1.5 times of vibration time.
2. Wait until system is stable.
3. If vibration is lasting, decrease integral time 30%.
4. Wait until system is stable
5. Repeat 3 and 4 until vibration is removed.

If vibration time is shorter than integral time
1. Decrease proportional gain 30%.
2. Wait until system is stable
3. Repeat 1 and 2 until vibration is removed.

(※4) Detect low superheat alarm

This alarm is caused by superheat is low. Once superheat begins to low, expansion valve start to close more.

If low superheat alarm is occurred, expansion valve is fully closed.

(※5) Maximum operating pressure alarm mode (MOP)

Once maximum operating pressure alarm is occurred, expansion valve is fully closed. Please press RST button to remove alarm.

(※6) Detect high superheat alarm

This alarm is caused by superheat is high. Once superheat begins to high, expansion valve start to open more.

If high superheat alarm is occurred, expansion valve is fully closed.

(※7) Detect freezing protection alarm

If freezing protection alarm is occurred caused by temperature of evaporator is getting low, expansion valve is fully closed.

(※8) Pumpdown function

If input pumpdown delay time of 0 to 180 sec, auxiliary relay (RL1) outputs it as compressor control purpose.

Switch (S4) turns on, RL1 start to run

Switch (S4) turns off, RL1 will be turned off. (Less than pumpdown finish pressure)

But even if pumpdown delay time passed, unless it is not yet pumpdown finish pressure, RL1 will be turned off immediately.

(※9) Detect low limit pressure alarm

If pressure is dropping up to less than LOP for more than LPd, low limit pressure alarm will be occurred and expansion valve is fully closed.

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: PARAMETER TABLE IN GROUP 2 (*2.Pr*)

Address	Function	Code	Unit	Step	Min.	Max.	Default	Custom
4 0061	Password (※1)	*PCd*	-	1	0	999	5	
4 0062	Type of refrigerant	*rFY*	0(*22*)= R22 3(*407*)= R407C, 5(*717*)= R717 1(*134*)= R134A 4(*410*)= R410A 6(*23*)= R23 2(*404*)= R404A				*22*	
4 0063	Pressure sensor max. range (at 20mA) (※2)	*PSH*	barg	1	-1	99	9	
4 0064	Pressure sensor min. range (at 4mA) (※2)	*PSL*	barg	1	-1	99	-1	
4 0065	Pressure sensor offset correction	*PCr*	K	0.1	-9.9	9.9	0.0	
4 0066	Temp. sensor offset correction	*tCr*	K	0.1	-19.9	19.9	0.0	
4 0069	Control ratio slope limit of expansion valve (%)(※3)	*JEt*		0.1	0.1	100.0	100.0	
4 0070	Expansion valve open ratio upper limit (※4)	*oPH*	%	1	0	100	100	
4 0071	Expansion valve open ratio lower limit (※4)	*oPL*	%	1	0	100	0	
4 0072	Sensor input filter	*oll*	second	0.1	0.1	9.9	1.0	
4 0073	Expansion valve compulsory open ration (※5)	*UCr*	%	0.1	0.0	100.0	*oFF*(-1)	
4 0074	Valve control output cycle (※6)	*Prt*	second	0.1	1.0	99.9	6.0	
4 0076	Display mode	*diS*	*0*= 1~4 Rotation *3*= Current open ratio of expansion *1* = Superheat *4*= Temperature *2*= Pressure				*1*	
4 0077	Run/Stop method	*rnt*	*0*= Always run *2*= Communication run (Remote) *1* = Digital input (ID1)				*1*	
4 0078	Communication ID setup	*id*	-	1	1	128	1	
4 0079	Communication speed (BPS) setup	*bdr*	0(*48*)= 4800 1(*96*)= 9600 2(*192*)= 19200 3(*384*)= 38400				*96*	
	Initialization (※7)	*rSt*	-	1	0	999	0	

(※1) Password

It is necessary to input password to change or initialize parameters and default value is "5".
Be sure to take notes not to forget or loss it after changing password.

(※2) Setup max. and min. range of pressure sensor

Setup maximum and minimum range of pressure sensor. Pressure sensor is a ratiometric type of 4 ~ 20mA
Default value before shipment is 1~15bar

(※3) Control ratio slope limit of expansion valve

limit control variation ratio per 1 second (for response speed limit)

(※4) Input upper and lower limit of expansion valve open ration

In case of controlling normally, expansion valve can't be opened more than upper limit of open ration and can't be closed less than lower limit of open ration. Default values before shipment are 100% for upper limit and 0% for lower limit respectively.

**(※5) Expansion valve compulsory open ratio**

If users want to temporarily control expansion valve by designated open ratio while controlling normally. Default value before shipment is OFF.

(※6) Electronic expansion valve control cycle

FX32EV is a control device for ON/OFF type electronic expansion valve.
(it can't control expansion valve of stepping motor type.)
-. It is possible to control from 0.0 to 100.0 % by unit of 0.1% as a PWM (pulse width modulation) control type.
-. Control cycle can be settable from 1sec to 99.9 sec. (control by unit of 10msec)
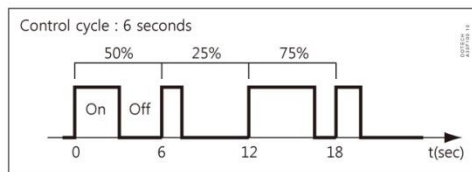
(※7) Initialization

If password is entered, parameters will be initialized as an default value before shipment.

: STATE MESSAGE

Code	Description	Code	Description
820	Display product model name (FX32EV-00)	*StP*	Operation stop
840	Display product model name (FX32EV-R4)	*CAL*	Expansion valve initialization
P1.4	Display program revision No.	*Pdn*	Pumpdown operation

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: TRIP / ALARM MESSAGE

No.	Description	Code	Parameter	Occur	Reset
1	Pressure sensor disconnection	PoP		Please check a pressure sensor because pressure sensor is open.	It will be cleared when pressure sensor is normal
2	Pressure sensor short circuit	PSt		Please check a pressure sensor because pressure sensor is short.	
3	Temp. sensor disconnection	toP		Please check a temp sensor because temp sensor is open.	It will be cleared when pressure sensor is normal
4	Temp. sensor short circuit	tSt		Please check a temp sensor because temp sensor is short.	
5	Detect MOP	$\bar{n}oP$	$\bar{n}P$= 1	It will occur when present pressure is higher than set value of $\bar{n}oP$.	It will be cleared when present pressure is lower than set value of $\bar{n}PF$.
6	Detect lower limit pressure alarm	LoP LoP Flickering	LP= 1 LP= 2	It will occur present pressure is lower than set value of LoP due to lack of refrigerant and etc. ※ Check of system is needed.	It will be cleared when present pressure is higher than set values of LPF.
7	Detect high superheat alarm	HSH HSH Flickering	HS= 1 HS= 2	It will occur when present superheat is higher than the value of $SH+HSH$. ※ Check of system is needed.	It will be cleared when present superheat is lower than set value of $SH+HSF$.
8	Detect low superheat alarm	LSH LSH Flickering	LS= 1 LS= 2	It will occur when present superheat is lower than the value of $SH+LSH$. ※ Check of system is needed.	It will be cleared when present superheat is higher than set value of $SH+LSF$.
9	Detect freezing protection alarm	FrE FrE Flickering	Fr= 1 Fr= 2	It will occur when present temperature is lower than the value of FrE. ※ Check of system is needed.	It will be cleared when present temperature is lower than set value of FrF.

※ EEV (Electronic Expansion Valve will be completely closed when trip alarm occurs and alarm output turns on.

: STATUS / COMMUNICATION TABLE

Address	Description	Unit	Type	Data Type	FX	MMI	USER SETTINGS
4 0073	Expansion valve compulsory open ration (※1)	%	Analog	INT 16	0.0 - 100.0	X 10	
4 0099	Request reset	-	Analog	INT 16	0 : OFF	1 : ON	
4 0101	Run/Stop state (※2)	-	Analog	INT 16	0 : STOP	1 : RUN	
4 0102	Operation state	-	Analog	INT 16	refer to below to see bit		
Bit0	Operation state of EEV	-	Digital	Bit	0 : OFF	1 : ON	
Bit1	Auxiliary relay output	-	Digital	Bit	0 : OFF	1 : ON	
4 0110	Alarm	-	Analog	INT 16	refer to below to see bit		
Bit0	Pressure sensor disconnection	-	Digital	Bit	0 : OFF	1 : ON	
Bit1	Pressure sensor short circuit	-	Digital	Bit	0 : OFF	1 : ON	
Bit2	Temp. sensor disconnection	-	Digital	Bit	0 : OFF	1 : ON	
Bit3	Temp. sensor short circuit	-	Digital	Bit	0 : OFF	1 : ON	
Bit4	MOP alarm	-	Digital	Bit	0 : OFF	1 : ON	
Bit5	Lower limit pressure alarm	-	Digital	Bit	0 : OFF	1 : ON	
Bit6	High superheat alarm	-	Digital	Bit	0 : OFF	1 : ON	
Bit7	Low superheat alarm	-	Digital	Bit	0 : OFF	1 : ON	
Bit8	Freezing prevention alarm	-	Digital	Bit	0 : OFF	1 : ON	
4 0111	Current superheat	K	Analog	INT 16		X 10	
4 0112	Saturation temperature	℃	Analog	INT 16		X 10	
4 0113	Evaporator outlet pressure	bar	Analog	INT 16	-1.0 ~ 9.0	X 10	
4 0114	Evaporator outlet temperature	℃	Analog	INT 16	-100.0 – 100.0	X 10	
4 0116	Current expansion valve open ratio	%	Analog	INT 16	0.0 - 100.0	X 10	

(※1) How to control manually expansion valve by using communication

Just inputting 0.0 ~ 100.0 at UCr (Expansion valve compulsory open ration) electronic expansion valve will be manually controlled regardless of superheat of present system

Input "-1" at address 4 0073 to release UCr (Expansion valve compulsory open ration). Then it will be transferred to automatic control mode.

But, electronic expansion valve will be automatically closed at state of stop or alarm.

(※2) Operation RUN/STOP by using communication

※ $r\bar{n}t$ (Run/Stop method) : need to set RUN/STOP method through communication (2)

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