KE2 Temp + Defrost Modbus Communications

The implementation of MODBUS in the KE2Temp is compatible with MODBUS Application Protocol Specification V1.1b. There are public and user-defined function codes implemented.
The MODBUS operates over RS485 serial transport at 9600 8N2 settings in RTU mode.

When using MODBUS hardware/software it is necessary to translate KE2 coil/register addresses to PLC/MODBUS addresses as follows: KE2 setpoint 0 (ts) would be register 1. MODBUS places register address 1 on wire as 0. Example, for Allen-Bradly software interface, to read SP ts operator would use register address 1 and PLC would output register address 0 on the wire.

KE2 Temp + Defrost Modbus Communications

Read Relay Status (MODBUS Read Coils)

This command is used to retrieve current state of the relay.

Command:

    KE2Temp MODBUS Address
    Function 0x01
    Starting Address High
    Starting Address Low
    Coil Count High
    Coil Count Low
    CRC High
    CRC Low

KE2Temp MODBUS Address is from 1 to 247.
Starting Address is always 0.
Coil Count is always 1.

Response

    KE2Temp MODBUS Address
    Function 0x01
    Byte Count = 1
    Coil   Status = 1/0 (Engaged/Disengaged)
    CRC High
    CRC Low

Error

    KE2Temp MODBUS Address
    Function with Error 0x81
    Exception Code 0x01 or 0x02 or 0x03

KE2 Temp + Defrost Modbus Communications

Read Set Points (MODBUS Read Holding Registers)

This command is used to read current values of the set points. There are 23 set points available in the KE2Temp device.

All setpoints are read 10x to values. It is done to utilize full resolution for temperature values. Example, when temp setpoint reads (0x03, 0x84) it means 0x0384 = 900, divided by 10 results in 90 degrees.

Setpoint Name	Address
Temperature Setpoint	0
Temperature Differential	1
Maximum Compressor Starts per hour	2
Number of Defrosts per Day	3
Time Of Day	4 (See Note 1 below)
Start Time of Defrost 1	5 (See Note 2 below)
Start Time of Defrost 2	6 (See Note 2 below)
Start Time of Defrost 3	7 (See Note 2 below)
Start Time of Defrost 4	8 (See Note 2 below)
Start Time of Defrost 5	9 (See Note 2 below)
Start Time of Defrost 6	10 (See Note 2 below)
Start Time of Defrost 7	11 (See Note 2 below)
Start Time of Defrost 8	12 (See Note 2 below)
Start Time of Defrost 9	13 (See Note 2 below)
Start Time of Defrost 10	14 (See Note 2 below)
Start Time of Defrost 11	15 (See Note 2 below)
Start Time of Defrost 12	16 (See Note 2 below)
Defrost Time	17
High Alarm Offset	18
Low Alarm Offset	19
High and Low Alarm Delay	20
MODBUS Address	21
Temperature Units	22

Command:

  KE2Temp MODBUS Address
  Function 0x03
  Starting Address High
  Starting Address Low
  Set Point Count High
  Set Point Count Low
  CRC High

KE2 Temp + Defrost Modbus Communications

CRC Low

KE2Temp MODBUS Address is from 1 to 247.
Starting Address is from 0 to 9.
Set Point Count from 1 to 10.

Response
    KE2Temp MODBUS Address
    Function 0x03
    Byte Count
    Set Point Value High
    Set Point Value Low
    Set Point Value High
    Set Point Value Low
    CRC High
    CRC Low

Error
    KE2Temp MODBUS Address
    Function with Error 0x83
    Exception Code 0x01 or 0x02 or 0x03

NOTE 1. How To Interpret Time Setpoint 4

The two byte time return value represents upper and lower byte of 10x number of minutes lapsed. For example, 0x28 0x6E is 0x286E = 10350 decimal (it is 1035 total minutes multiplied by 10).

1. First, divide by 10 to get 1035 total minutes.
2. Second, divide by 60 to find hour count (1035/60 = 17). Hence, it is 17 hours.
3. Third, find minutes. Those are the remainder of step 2 and can be found as following: minutes = total minutes – (hours * 60). For the example, it is 1035 – (17*60) = 15 minutes.

The 0x286e (10350) means 17hours 15 minutes. Mind that on the 3-digit unit's led display it will show as 17.1. Once it reaches 20 to 29 minutes, it will display 17.2 and so on.

NOTE 2. How To Interpret Time Setpoints 5 – 16

These setpoints are on hour boundaries and read 10 times the hours. For example, 0x00D2 is 210 decimal. Divided by 10 it is 21 hours.

KE2 Temp + Defrost Modbus Communications

Read Temps, System Status, Alarms (MODBUS Read Input Registers)

This command is used to read current room temperature, system state and alarms.

Command:
> KE2Temp MODBUS Address
> Function 0x04
> Starting Address High
> Starting Address Low
> Register Count High
> Register Count Low
> CRC High
> CRC Low

KE2Temp MODBUS Address is from 1 to 247.
Starting Address is always 0.
Register Count is always 3.

Response
> KE2Temp MODBUS Address
> Function 0x04
> Byte Count 6
> Room Temp High
> Room Temp Low
> System Status High
> System Status Low
> Alarms High
> Alarms Low
> CRC High
> CRC Low

Value	System Status
0x01	COOL
0x02	OFF
0x04	DEFROST
Value	Alarm
0x01	SENSOR OPEN
0x02	SENSOR SHORT

KE2 Temp + Defrost Modbus Communications

0x04	HIGH TEMP
0x08	LOW TEMP

Error

KE2Temp MODBUS Address

Function with Error 0x84

Exception Code 0x01 or 0x02 or 0x03

KE2 Temp + Defrost Modbus Communications

Force Relay State (MODBUS Write Single Coil)

This command is used to directly control relay. Once this command is issued the relay operates under control of MODBUS commands regardless of system state. In order to return the relay under the system control MODBUS command Return Relay must be issued.

Command

>KE2Temp MODBUS Address
>
>Function 0x05
>
>Starting Address High
>
>Starting Address Low
>
>Value High
>
>Value Low
>
>CRC High
>
>CRC Low

KE2Temp MODBUS Address is from 1 to 247.

Starting Address is always 0.

Value is 0xFF00 to engage relay or 0x0000 to release relay.

Response

>KE2Temp MODBUS Address
>
>Function 0x05
>
>Starting Address High
>
>Starting Address Low
>
>Value High
>
>Value Low
>
>CRC High
>
>CRC Low

Error

>KE2Temp MODBUS Address
>
>Function with Error 0x85
>
>Exception Code 0x01 or 0x02 or 0x03

KE2 Temp + Defrost Modbus Communications

Write Set Point (MODBUS Write Holding Register)

This command is used to change current values of the set points. There are 23 set points available in the KE2Temp device.

All setpoints are written 10x to values. It is done to utilize full resolution for temperature values during read operation. For write operation value has to be divisible by 10. Example, when temp setpoint is set to 90 degrees, multiply by 10 to get 900(0x384) and split into bytes (0x03, 0x84).

Setpoint Name	Controller Text	Address	Min Value	Max Value	Units
Temperature Setpoint	ts	0	-50	100	Degree F
Temperature Differential	diF	1	1	10	Degree F
Max Comp starts per hour	CSH	2	OFF=0, 5	10	times
Number of Defrosts per Day	dPd	3	CUS = 13, 0	12	times
Time Of Day	tOd	4	0	0x3836	See Note 1
Start Time Defr. 1	d1	5	DIS=24, 0	23	See Note 2
Start Time Defr. 2	d2	6	DIS=24, 0	23	See Note 2
Start Time Defr. 3	d3	7	DIS=24, 0	23	See Note 2
Start Time Defr. 4	d4	8	DIS=24, 0	23	See Note 2
Start Time Defr. 5	d5	9	DIS=24, 0	23	See Note 2
Start Time Defr. 6	d6	10	DIS=24, 0	23	See Note 2
Start Time Defr. 7	d7	11	DIS=24, 0	23	See Note 2
Start Time Defr. 8	d8	12	DIS=24, 0	23	See Note 2
Start Time Defr. 9	d9	13	DIS=24, 0	23	See Note 2
Start Time Defr. 10	d10	14	DIS=24, 0	23	See Note 2
Start Time Defr. 11	d11	15	DIS=24, 0	23	See Note 2
Start Time Defr. 12	d12	16	DIS=24, 0	23	See Note 2
Defrost Time	dft	17	0	720	minutes
High Alarm Offset	HAO	18	1	10	Degree F
Low Alarm Offset	LAO	19	1	10	Degree F
High and Low Alarm Delay	tAd	20	1	180	min
MODBUS Address	Adr	21	1	247	
Temp Units	Unt	22	FAH=0	CEL=1	

KE2 Temp + Defrost Modbus Communications

Command

> KE2Temp MODBUS Address
>
> Function 0x06
>
> Starting Address High
>
> Starting Address Low
>
> Set Point Value High
>
> Set Point Value Low
>
> CRC High
>
> CRC Low

KE2Temp MODBUS Address is from 1 to 247.

Starting Address is from 0 to 9.

Value depends on Set Point (see table above).

Response

> KE2Temp MODBUS Address
>
> Function 0x06
>
> Starting Address High
>
> Starting Address Low
>
> Set Point Value High
>
> Set Point Value Low
>
> CRC High
>
> CRC Low

Error

> KE2Temp MODBUS Address
>
> Function with Error 0x86
>
> Exception Code 0x01 or 0x02 or 0x03

NOTE 1. How To Set Time Setpoint 4

> The two byte time value represents upper and lower byte of 10x number of minutes lapsed. For example, 0x28 0x6E is 0x286E = 10350 decimal. To set 15 hours 14 minutes follow the steps.

1. First, multiply hours by 60 (15 * 60 = 900).
2. Second, add minutes to the result (900 + 14 = 914 total minutes).
3. Third, multiply by 10 and convert to hex (914 * 10 = 9140 decimal = 0x23B4).

KE2 Temp + Defrost Modbus Communications

4. Now, the Set Point Value Low is lowest two digits B4 (if only one digit present then Set Point Value Low is that digit). The Set Point Value High is the upper digits 23 (if only one digit present then Set Point Value High is that digit). For reference, 0x145 => 0x01,0x45; 0x1206 => 0x12,0x06; 0x89=>0x00,0x89;0x8=>0x00,0x08.
5. Send the command [Addr,0x06,0x00,0x04,0x23,0xB4,0xD1,0x4C].

NOTE 2. How To Set Time Setpoints 5 – 16
These setpoints are on hour boundaries and set 10 times the hours. For example, 21 hours multiplied by 10 is 210 decimal (0x00D2 in hex). The command would be [Addr, 0x06, 0x00,0x5,0x00,0xD2,0x19,0x96] where SP address is 0x0005 and setpoint value is 0x00D2.

KE2 Temp + Defrost Modbus Communications

Return Relay

Custom function code

This command is used to return the relay under the system control (see Force Relay command).
Command (custom)
       KE2Temp MODBUS Address
       Function 0x46
       Relay Address High
       Relay Address Low
       CRC High
       CRC Low

KE2Temp MODBUS Address is from 1 to 247.
Relay Address is always 0.

Response
       KE2Temp MODBUS Address
       Function 0x46
       Relay Address High
       Relay Address Low
       CRC High
       CRC Low

Error
       KE2Temp MODBUS Address
       Function with Error 0xC6
       Exception Code 0x01 or 0x02 or 0x03

Standard function code

Command (standard, Write Holding Register 0x06)
       KE2Temp MODBUS Address
       Function 0x6
       Starting Address High
       Starting Address Low

KE2 Temp + Defrost Modbus Communications

Set Point Value High
Set Point Value Low
CRC High
CRC Low

KE2Temp MODBUS Address is from 1 to 247.
Starting Address is 0x007B.
Set Point Value is any.

Response
KE2Temp MODBUS Address
      Function 0x6
      Starting Address High
      Starting Address Low
      Set Point Value High
      Set Point Value Low
      CRC High
      CRC Low

Error
      KE2Temp MODBUS Address
      Function with Error 0x86
      Exception Code 0x01 or 0x02 or 0x03

KE2 Temp + Defrost Modbus Communications

FW Version

This command returns major and minor firmware version.

Custom function code

Command:

> KE2Temp MODBUS Address
>
> Function 0x48
>
> CRC High
>
> CRC Low

KE2Temp MODBUS Address is from 1 to 247.

Response

> KE2Temp MODBUS Address
>
> Function 0x48
>
> Byte Count = 4
>
> Major Version High
>
> Major Version Low
>
> Minor Version High
>
> Minor Version Low
>
> CRC High
>
> CRC Low

Error

> KE2Temp MODBUS Address
>
> Function with Error 0xC8
>
> Exception Code 0x01 or 0x02 or 0x03

Standard function code

Command (standard, Read Holding Register 0x03)

> KE2Temp MODBUS Address
>
> Function 0x3
>
> Starting Address High
>
> Starting Address Low
>
> Set Point Count High
>
> Set Point Count Low
>
> CRC High
>
> > CRC Low

KE2 Temp + Defrost Modbus Communications

KE2Temp MODBUS Address is from 1 to 247.
Starting Address is 0x0078.
Set Point Count is 0x0002.

Response
KE2Temp MODBUS Address
Function 0x03
Byte Count = 4
Major Version High
Major Version Low
Minor Version High
Minor Version Low
CRC High
CRC Low

Error
KE2Temp MODBUS Address
Function with Error 0x83
Exception Code 0x01 or 0x02 or 0x03

KE2 Temp + Defrost Modbus Communications

Force Next Sequence

This command forces defrost state to change. When issued in COOL/OFF mode this command forces the system into defrost. Further defrost functionality is according to the defrost schedule. When issued in DEFROST mode this command terminates defrost. Further defrost functionality is according to the defrost schedule.

Custom function code

Command:
>KE2Temp MODBUS Address
>Function 0x47
>CRC High
>CRC Low

KE2Temp MODBUS Address is from 1 to 247.

Response
>KE2Temp MODBUS Address
>Function 0x47
>CRC High
>CRC Low

Error
>KE2Temp MODBUS Address
>Function with Error 0xC7
>Exception Code 0x01 or 0x02 or 0x03

Standard function code

Command (standard, Write Holding Register 0x06)
>KE2Temp MODBUS Address
>Function 0x6
>Starting Address High
>Starting Address Low
>Set Point Value High
>Set Point Value Low
>CRC High
>CRC Low

KE2 Temp + Defrost Modbus Communications

KE2Temp MODBUS Address is from 1 to 247.

Starting Address is 0x007C.

Set Point Value is any.

Response

     KE2Temp MODBUS Address

     Function 0x6

     Starting Address High

     Starting Address Low

     Set Point Value High

     Set Point Value Low

     CRC High

     CRC Low

Error

     KE2Temp MODBUS Address

     Function with Error 0x86

     Exception Code 0x01 or 0x02 or 0x03

KE2 Temp + Defrost Modbus Communications

FW Part Number

This command returns firmware part number.

Custom function code

Command:

    KE2Temp MODBUS Address
    Function 0x49
    CRC High
    CRC Low

KE2Temp MODBUS Address is from 1 to 247.

Response

    KE2Temp MODBUS Address
    Function 0x49
    Byte Count = 4
    FW Part Number High
    FW Part Number Low
    0
    0
    CRC High
    CRC Low

Error

    KE2Temp MODBUS Address
    Function with Error 0xC9
    Exception Code 0x01 or 0x02 or 0x03