TF3 Series

Refrigeration Temperature Controller

Features
- Standard installation size for refrigeration and air-cooling panels (W70.3×H28.2mm)
- Various compressor load current capacity: 5A, 16A, 20A
- Various user-friendly functions:
  - Defrost sync function:
  - Night mode operation and real-time defrost control
- Remote monitoring of real-time temperature and output control (using TFD series remote display unit, sold separately)
- Communication output models available: RS485 (Modbus RTU)
- Parameter configuration via PC (RS485 communication)
- IP65 protection structure (IEC standard): front panel only

Manual
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.
- User manual describes for specifications and function, and communication manual describes for RS485 communication (Modbus RTU protocol) and parameter address map data.

Comprehensive Device Management Program (DAQMaster)
- DAQMaster is comprehensive device management program. It is available for parameter setting, monitoring, and user parameter group setting, parameter mask setting for only TF3 Series.
- Visit our website (www.autonics.com) to download user manual and communication manual.

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>IBM PC compatible computer with Intel Pentium III or above</td>
</tr>
<tr>
<td>Operating system</td>
<td>Microsoft Windows 98/NT/XP/Vista/7/8/10</td>
</tr>
<tr>
<td>Memory</td>
<td>256MB or more</td>
</tr>
<tr>
<td>Hard disk</td>
<td>More than 1GB of free hard disk space</td>
</tr>
<tr>
<td>VGA</td>
<td>1024×768 or higher resolution display</td>
</tr>
<tr>
<td>Others</td>
<td>RS-232 serial port (9-pin), USB port</td>
</tr>
</tbody>
</table>

Please read "Safety Considerations" in operation manual before using.
Refrigeration Temperature Controller

Ordering Information

<table>
<thead>
<tr>
<th>Item</th>
<th>Output</th>
<th>Number of input channels</th>
<th>Digits</th>
<th>Power supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF</td>
<td>compressor output</td>
<td>1CH</td>
<td>1</td>
<td>1CH input (NTC or RTD) [temperature+digital input (DI)]</td>
</tr>
<tr>
<td></td>
<td>compressor output</td>
<td>1CH, 3CH</td>
<td>2</td>
<td>3CH input (NTC) [inlet temperature+defrost temperature+outlet temperature or digital input (DI)]</td>
</tr>
<tr>
<td></td>
<td>compressor output</td>
<td>3</td>
<td>3</td>
<td>999 (3-digit)</td>
</tr>
<tr>
<td></td>
<td>compressor output</td>
<td>4</td>
<td>100-240VAC 50/60Hz</td>
<td></td>
</tr>
</tbody>
</table>

※1: Only for 1CH input, compressor output model (TF31-1-G).

※2: Only for 3CH input model (TF33-3333). Option function is varied by compressor load capacity and contact.

<table>
<thead>
<tr>
<th>Option function</th>
<th>Compressor load capacity &amp; contact</th>
<th>Synchronize defrost function</th>
<th>RS485 communication</th>
<th>RTC function</th>
<th>RS485 communication+RTC function</th>
<th>No option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressor 5A 1a contact</td>
<td>(TF33-A-S)</td>
<td>●</td>
<td>(TF33-3-A-S)</td>
<td>●</td>
<td>(TF33-3-A-A)</td>
<td>●</td>
</tr>
<tr>
<td>Compressor 16A 1c contact</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

※3: Except compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF33-2-3).

※Only for 3CH input, compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF33-3-3-3) supports buzzer.

Remote Display Unit (TFD Series, Sold Separately)

Remote display unit (TFD) displays current temperature or output status of TF3 at remote place.

TFD cable is TFD-3: 3m, TFD-5: 5m.

Connect the phone-jack of remote display unit (TFD) to the data loader port of TF3.

This unit is dedicated for TF3 Series and it does not directly communicate with upper devices (PC, PLC, etc.)

If TFD communication with TF3 error occurs, TFD flashes display component for 1 sec. Check the connection with TF3.

※When connecting TFD to the data loader port of TF3, you cannot connect Autonics SCM-US (USB to Serial converter, sold separately), for communication. Use SCM-US48I(USB to RS485 converter, sold separately), SCM-38I(RS232C to RS485 converter, sold separately).
TF3 Series

Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>TF31-□□□□</th>
<th>TF33-□□□□</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of channels</td>
<td>1CH</td>
<td>3CH</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC power 100-240VAC ~ 50/60Hz</td>
<td>AC/DC power 24VAC ~ 50/60Hz, 12-24VDC=</td>
</tr>
<tr>
<td>Allowable voltage range</td>
<td>90 to 110% of rated voltage</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>AC power Max. 8VA (100-240VAC ~ 50/60Hz)</td>
<td>AC/DC power Max. 5VA (24VAC ~ 50/60Hz), Max. 3W (12-24VDC=)</td>
</tr>
<tr>
<td>Display method</td>
<td>7 Segment LED method (red)</td>
<td></td>
</tr>
<tr>
<td>Character size (W×H)</td>
<td>9.4×19.3mm</td>
<td></td>
</tr>
<tr>
<td>Input type</td>
<td>NTC 5kΩ/10kΩ</td>
<td>RTD DP100Ω</td>
</tr>
<tr>
<td>Sampling period</td>
<td>500ms</td>
<td></td>
</tr>
<tr>
<td>Display accuracy</td>
<td>At room temp. (23°C±5°C): ±1°C±1 digit</td>
<td>Out of room temp. range: ±2°C±1 digit</td>
</tr>
<tr>
<td>Control output</td>
<td>Compressor (COMP) 250VAC ~ 5A 1a, 16A 1c, 20A 1a</td>
<td>Defrost (DEF) 250VAC ~ 10A 1a</td>
</tr>
<tr>
<td>Communication output</td>
<td>—</td>
<td>RS485 communication output (Modbus RTU)</td>
</tr>
<tr>
<td>Digital input</td>
<td>Contact input: ON max. 1kΩ, OFF min. 100kΩ</td>
<td>No contact input: ON residual voltage: max. 1V, OFF leakage current: max. 1mA, outflow current: 4μA</td>
</tr>
<tr>
<td>Control method</td>
<td>ON/OFF control</td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>0.5 to 5.0°C, 2 to 10°F variable</td>
<td></td>
</tr>
<tr>
<td>Relay life cycle</td>
<td>Compressor (COMP) 5A 1a Mechanical: 5,000,000 operations, Electrical: 50,000 operations (250VAC 5A)</td>
<td>16A 1c Mechanical: 20,000,000 operations, Electrical: 30,000 operations (250VAC 16A)</td>
</tr>
<tr>
<td></td>
<td>20A 1a Mechanical: 10,000,000 operations, Electrical: 100,000 operations (250VAC 20A)</td>
<td>Defrost (DEF) Mechanical: 20,000,000 operations, Electrical: 100,000 operations (250VAC 10A)</td>
</tr>
<tr>
<td></td>
<td>Auxiliary (AUX) Mechanical: 5,000,000 operations, Electrical: 50,000 operations (250VAC 5A)</td>
<td></td>
</tr>
<tr>
<td>Memory retention</td>
<td>Approx. 10 years (non-volatile memory method)</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>Min. 100MΩ (at 500VDC megger)</td>
<td></td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>AC power 3000VAC 50/60Hz for 1 min (between all terminals and case, power and input circuit)</td>
<td></td>
</tr>
<tr>
<td>Noise resistance</td>
<td>Square-wave noise by the noise simulator (pulse width: 1μs) ±2kV R-phase and S-phase</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours</td>
<td></td>
</tr>
<tr>
<td>Environment Ambient temperature</td>
<td>-10 to 50°C, storage: -20 to 60°C</td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35 to 85%RH, storage: 35 to 85%RH</td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Bracket: 2, NTC sensor (5kΩ): 1</td>
<td></td>
</tr>
<tr>
<td>Protection structure</td>
<td>IP65 (front case)</td>
<td></td>
</tr>
<tr>
<td>Approval</td>
<td>CE, FCC (Class A)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 207g (approx. 105g)</td>
<td></td>
</tr>
</tbody>
</table>

Remote display unit [TFD]

<table>
<thead>
<tr>
<th>Model</th>
<th>TFD-3</th>
<th>TFD-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>3.3VDC=</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>Max. 1W</td>
<td></td>
</tr>
<tr>
<td>Display method</td>
<td>7 Segment LED method (red)</td>
<td></td>
</tr>
<tr>
<td>Communication method</td>
<td>Serial (TTL Level), Half duplex</td>
<td></td>
</tr>
<tr>
<td>Communication cycle</td>
<td>100ms</td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>Ø2.5mm, 3m</td>
<td>Ø2.5mm, 5m</td>
</tr>
<tr>
<td>Vibration</td>
<td>1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours</td>
<td></td>
</tr>
<tr>
<td>Environment Ambient temp.</td>
<td>-10 to 50°C, storage: -20 to 60°C</td>
<td></td>
</tr>
<tr>
<td>Ambient humid.</td>
<td>35 to 85%RH, storage: 35 to 85%RH</td>
<td></td>
</tr>
<tr>
<td>Protection structure</td>
<td>IP67</td>
<td></td>
</tr>
<tr>
<td>Approval</td>
<td>CE, FCC (Class A)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 77g (approx. 48g)</td>
<td></td>
</tr>
</tbody>
</table>

※1: The weight includes packaging. The weight in parentheses is for unit only.

The weight is varied by model option.

※Environment resistance is rated at no freezing or condensation.
Connections

※Use crimp terminals of size specified below.

<table>
<thead>
<tr>
<th>Terminal number</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>1 to 4</td>
<td>4 to 6mm</td>
<td>Max. 1.7mm</td>
</tr>
<tr>
<td>TF3-H-H</td>
<td>5 to 10</td>
<td>6 to 8mm</td>
<td>Max. 2.3mm</td>
</tr>
<tr>
<td>TF3-A-A</td>
<td>5 to 6</td>
<td>6mm</td>
<td>Max. 1.9mm</td>
</tr>
<tr>
<td>TF3-G-G</td>
<td>7 to 10</td>
<td>6 to 8mm</td>
<td>Max. 2.3mm</td>
</tr>
<tr>
<td>General</td>
<td>11 to 12</td>
<td>6mm</td>
<td>Max. 1.9mm</td>
</tr>
</tbody>
</table>

● TF31-1G

COMP OUT
250VAC 20A
RESISTIVE LOAD

SOURCE
100-240VAC 50/60Hz,
24VAC 50/60Hz,
12-24VDC

NTC 5K/10K
SENSOR
DIGITAL INPUT

1 2 3 4 5 6 7 8 9 10 11 12

● TF31-A

COMP OUT
250VAC 5A
RESISTIVE LOAD

DEF OUT
250VAC 10A
RESISTIVE LOAD

AUX OUT
250VAC 5A
RESISTIVE LOAD

SOURCE
100-240VAC 50/60Hz,
24VAC 50/60Hz,
12-24VDC

NTC 5K/10K
SENSOR
DIGITAL INPUT

1 2 3 4 5 6 7 8 9 10 11 12

● TF33-A

COMP OUT
250VAC 5A
RESISTIVE LOAD

DEF OUT
250VAC 10A
RESISTIVE LOAD

AUX OUT
250VAC 5A
RESISTIVE LOAD

SOURCE
100-240VAC 50/60Hz,
24VAC 50/60Hz,
12-24VDC

NTC 5K/10K
SENSOR
DIGITAL INPUT

S1 S2 S3 COM A B SYNCHRONIZE

1 2 3 4 5 6 7 8 9 10 11 12

● TF33-H

COMP OUT
250VAC 16A
RESISTIVE LOAD

DEF OUT
250VAC 10A
RESISTIVE LOAD

AUX OUT
250VAC 5A
RESISTIVE LOAD

SOURCE
100-240VAC 50/60Hz,
24VAC 50/60Hz,
12-24VDC

NTC 5K/10K
SENSOR
DIGITAL INPUT

S1 S2 S3 COM

1 2 3 4 5 6 7 8 9 10 11 12

※1: Only for compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3-2-□-□).

※2: Only for compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3-3-□-□).

※3: Only for synchronize defrost function model (TF33-□-A-S), or RS485 communication model (TF33-□-A-T/A).
TF3 Series

Dimensions

TF3 Series

- NTC sensor (5kΩ)
  - Max. 5
  - AWG22 TPE lead wire
  - Max. 15
  - 2000±50

- Bracket

- Panel cut-out

TFD (sold separately)

<table>
<thead>
<tr>
<th>Series</th>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF3</td>
<td>Min. 100</td>
<td>Min. 55</td>
<td>70.3&quot;</td>
<td>28.2&quot;</td>
<td></td>
</tr>
<tr>
<td>TFD</td>
<td>Min. 65</td>
<td>Min. 40</td>
<td>45.7&quot;</td>
<td>25.4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

※1. When connecting remote display unit (TFD), or SCM-US, Min. 120

Sold Separately

Communication converter

- SCM-WF48
  - (Wi-Fi to RS485·USB wireless communication converter)
- SCM-US48I
  - (USB to RS485 converter)
- SCM-38I
  - (RS232C to RS485 converter)
- SCM-US
  - (USB to Serial converter)
Refrigeration Temperature Controller

**Product Mounting**

Insert the unit into a panel, fasten the bracket by pushing with tools with a (-) driver.

**Unit Description**

1. **Present value (PV) display component (red):**
   - **RUN mode:** Displays present value (PV).
   - **Setting mode:** Displays parameter and setting value.

2. **Deviation indicator (●: green, ▼/▲: red):**
   - Displays deviation of present value (PV) based on setting value (SV).
   - **Less than -1.8℃ ▼ indicator turns ON**
   - **Within ±1.8℃ ■ indicator turns ON**
   - **More than 1.8℃ ▲ indicator turns ON**

3. **Compressor (COMP) output indicator (green):**
   - Turns ON for compressor output. In case of compressor protection operation and output does not turn ON, it flashes. When operating compressor continuously, it turns ON for 2 sec, and turns OFF for 1 sec.

4. **Defrost (DEF) output indicator (green):**
   - Turns ON for defrost output. Flashes for defrost delay operation.
   - Turns ON for 2 sec and OFF for 1 sec for manual defrost or Power ON defrost.

5. **Evaporator-fan (FAN) output indicator (green):**
   - Turns ON for evaporator-fan output. Flashes for delay operation of evaporator-fan output.

6. **Auxiliary (AUX) output indicator (green):**
   - Turns ON for alarm output. Flashes for delay operation of alarm output.

7. **Unit indicator (red):**
   - Displays temperature unit set at temperature unit [UNT] of parameter 1 group.

8. **(MODE) key:**
   - Used for entering parameter setting group, returning RUN mode, moving parameter or saving SV.

9. **(AUX) key:**
   - Used for entering SV setting group or changing setting value.
   - Hold the key over 3 sec to select active/inactive auxiliary output in RUN mode.

10. **(DEF) key:**
    - Used for entering SV setting group or changing setting value.
    - Hold the key over 3 sec to execute/stop manual defrost in RUN mode.

11. **(COMP) key:**
    - Used for entering SV setting group, changing setting value, moving digits.
    - Hold the key over 3 sec to active/inactive compressor output in RUN mode.
    - When buzzer alarm occurs, press the key once to stop the sound. (Only for 3CH input, compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF33-3-□□□□□) supports buzzer.
    - Buzzer [BUZ] of parameter 1 group is set as [□□□□□])

12. **Data loader port:**
    - It is for displaying TF3 data at remote display unit (TFD) by connecting phone-jack.
    - In other case, for connecting Autonics SCM-US (USB/Serial converter, sold separately), it is a PC loader port of serial communication for parameter setting or monitoring by PC.
Parameter Group

1. Parameter Group

- Press any key among P5, P5, once
- When PW is valid
- Saved automatically after 3 sec

2. When PW is valid
- Display selection [DpT]
- Monitoring time [MoT]
- Max. value [hPK]
- Min. value [lPK]

3. User parameter 0
- User parameter 1 to 29

4. Parameter user group [PRU] x 2
- Input type [INT]
- Input sensor 2 ON/OFF [S2]
- Input sensor 3 selection [S3]
- Virtual temperature rate [VtR]
- Temperature unit [UNT]
- Input correction 1 [Ib1]
- Input correction 2 [Ib2]
- Input correction 3 [Ib3]
- Delay display period [DsT]
- Defrost/auxiliary output [sDA]
- Auxiliary output [AUX]
- Buzzer [BUZ]

5. Parameter 1 group [PAE] x 2
- SV setting [SV]
- Parameter 1 group
- Display selection [DpT]
- SV setting [SV]

※1. [P5] parameter appears only when password is set.
   The default password is [000]. If password is not valid, the password code appears. Press any key among the 5, 5, 5 keys to return to password entering window. Press the 5 key to return to RUN mode.
   If you forget password, contact Autonics after checking password code.

※2. It appears when setting user parameter group in the comprehensive device management program (DAQMaster).
※ Press the 5 key after changing the setting to save the SV.
※ Hold the 5 key for 1.5 sec while in setting mode to move to the parameter group.
※ Hold the 5 key for 3 sec while in setting mode to return RUN mode.
※ Press the 5 key at the last parameter of each parameter group, it moves to that parameter group name. You can move to other groups with 5, 5, 5 keys.
※ If there is no additional key operation within 30 sec after entering into setting mode, it will be automatically returned to RUN mode and previous setting value will be remained.
※ The shaded parameters are displayed when user level [USR] of parameter 5 group is set as standard level [STD].

[Diagram of Parameter Group]

Autonics
Refrigeration Temperature Controller

Parameter 2 group [PA2]
- Comp. output mode (\(P_{o1}\))
- Hysteresis (\(H_{y5}\))
- Offset (\(O_{f5}\))
- SV high-limit (\(H_{yw}\))
- SV low-limit (\(L_{w}\))
- Night mode (\(n_{m}\))
- Night mode SV correction (\(n_{sv}\))
- Night mode offset (\(n_{of}\))
- Night mode start hour (\(n_{eh}\))
- Night mode start min (\(n_{em}\))
- Night mode end hour (\(n_{eh}\))
- Night mode end min (\(n_{em}\))
- Temperature monitoring (\(T_{m}\))
- Comp. start-up delay time (\(S_{d}\))
- Comp. min. operation cycle (\(C_{y}\))
- Comp. restart delay time (\(R_{d}\))
- Comp. min. operation time (\(R_{t}\))
- Comp. continuous operation (\(C_{t}\))
- Alarm delay time after continuous operation (\(A_{dt}\))
- Comp. operation cycle when sensor break (\(A_{dc}\))
- Comp. duty rate when sensor break (\(A_{dc}\))
- 1.5sec

Parameter 3 group [PA3]
- Defrost method & operation (\(D_{ef}\))
- Defrost cycle (\(D_{c}\))
- Real-time defrost cycle (\(R_{c}\))
- Real-time defrost cycle 1 hour (\(R_{c1}\))
- Real-time defrost cycle 1 min (\(R_{c1}\))
- Pump down delay time (\(P_{dd}\))
- Defrost end delay time (\(D_{ed}\))
- Defrost end temperature (\(D_{et}\))
- Defrost hysteresis (\(D_{h}\))
- Defrost when power ON (\(P_{eo}\))
- Defrost delay when power ON/ manual defrost (\(A_{dd}\))
- Defrost group (\(G_{r}\))
- Parameter copy (\(P_{c}\))
- Prior defrost selection (\(P_{r}\))
- Defrost time unit (\(U_{t}\))
- Alarm delay after defrost/ door open (\(A_{dd}\))
- Temperature display during defrosting (\(T_{df}\))
- 1.5sec

Parameter 4 group [PA4]
- Alarm operation mode (\(A_{om}\))
- Alarm option (\(A_{ol}\))
- Alarm high-limit deviation (\(A_{ld}\))
- Alarm low-limit deviation (\(A_{ld}\))
- Alarm ON delay time (\(A_{on}\))
- Alarm OFF delay time (\(A_{of}\))
- External alarm delay time (\(A_{ed}\))
- Alarm output method (\(A_{om}\))
- Evaporator-fan operation (\(E_{of}\))
- Evaporator-fan control temperature (\(E_{ct}\))
- Evaporator-fan mode (\(E_{fn}\))
- Evaporator-fan hysteresis (\(E_{h}\))
- 1.5sec

Parameter 5 group [PA5]
- Current hour (\(C_{uh}\))
- Current minute (\(C_{um}\))
- Digital input (\(D_{i}\))
- Loop break alarm monitoring time (\(L_{br}\))
- Comm. address (\(R_{ad}\))
- Comm. speed (\(B_{ps}\))
- Comm. parity bit (\(P_{rb}\))
- Comm. stop bit (\(S_{lb}\))
- Comm. response wait time (\(C_{rw}\))
- Comm. write (\(C_{w}\))
- User level (\(U_{sl}\))
- SV setting group lock (\(L_{sw}\))
- Front key lock (\(L_{dk}\))
- PA 0 group lock (\(L_{p0}\))
- PA user group lock (\(L_{pu}\))
- PA 1 group lock (\(L_{p1}\))
- PA 2 group lock (\(L_{p2}\))
- PA 3 group lock (\(L_{p3}\))
- PA 4 group lock (\(L_{p4}\))
- PA 5 group lock (\(L_{p5}\))
- Password (\(P_{w}\))
- 1.5sec

Autonics H-9
Parameter 1 Group

2. After entering setting mode, hold the [C] (MODE) key anytime for 3 sec to return to RUN mode.
3. After entering setting mode, hold the [C] (MODE) key anytime for 1.5 sec to go to the concerned group name.
4. If you press the [C] (MODE) key after changing the set value of the parameter the set value will be stored.
5. Shaded parameters are for standard-level users, the others are for high-level users. (You can set the user level [USR] in parameter 5 group.)
6. This parameter might not be displayed depending on other parameter settings or model specifications.
7. Setting range: Refer to input type and range.
   - When changing input type, [SV], [hPK], [lPK], [Ib1], [Ib2], [Ib3], [HYS], [OFS], [HSV], [LSV], [nSV], [nHY], [EDT], [dHY], [ALH], [ALL], [RH], [fT], [fHY] parameter values are reset.
   - Appears only for 3CH input model.

Password input

Parameter 1

- Input type
- Input sensor 2 ON/OFF
- Input sensor 3 selection
- Virtual temperature rate
- Temperature unit
- Input correction 1
- Input correction 2
- Input correction 3
- Delay display period
- Defrost/auxiliary output
- Auxiliary output
- Buzzer

Setting range: 0 to 100%
- Appears only when input sensor 3 selection [t] is set as [t5].
- When changing temperature unit, [HPU], [LPV], [b1], [b2], [b3], [HYS], [OFS], [HSV], [LSU], [nSU], [nHY], [EDT], [dHY], [ALH], [ALL], [RH], [fT], [fHY] parameter values are reset.
- Setting range: -40 to 40°C/°F
- Appears only for 3CH input model.
- Setting range: 0.5 to 10.0 sec
- Appears only for compressor+defrost or auxiliary (alarm/evaporator-fan) output model.
- Appears only for compressor+defrost or auxiliary (alarm/evaporator-fan) output model, compressor+defrost+auxiliary (alarm/evaporator-fan).
- Only for 3CH input, compressor+defrost+auxiliary (alarm/evaporator-fan) output model supports buzzer.
Refrigeration Temperature Controller

Parameter 2 Group

1. Press any key among 1, 2, 3 keys.
2. After entering setting mode, hold the O (MODE) key anytime for 3 sec to return to RUN mode.
3. After entering setting mode, hold the O (MODE) key anytime for 1.5 sec to go to the concerned group name.
4. If you press the O (MODE) key after changing the set value of the parameter the set value will be stored.
5. Shaded parameters are for standard-level users, the others are for high-level users.
   (You can set the user level [USR] in parameter 5 group.)
6. This parameter might not be displayed depending on other parameter settings or model specifications.

Comp. output mode

- Setting range: 1 to 5°C (0.5 to 5.0°C), 2 to 10°F (2.0 to 10.0°F)
- Setting range: 0 to 5°C (0.0 to 5.0°C), 0 to 10°F (0.0 to 10.0°F)

Hysteresis

- Setting range: (LSV +1digit) to high-limit value of input type

Offset

- Setting range: low-limit value of input type to (HSV -1digit)

SV high-limit

- Setting range: -20 to 20°C (-20 to 20.0°C) / -50 to 50°F (-50 to 50.0°F)

SV low-limit

- Setting range: 0 to 23 hour

Night mode

- Setting range: 0 to 59 min

Night mode SV correction

- Appears for RTC function model or when digital input [n] is set as [n\_n\_d] in parameter 5 group.

Night mode hysteresis

- Does not appear when night mode [n\_n\_d] is set as [\_n\_n\_d].

Night mode offset

- Appears for RTC function model.

Night mode start hour

- Does not appear when night mode [n\_n\_d] is set as [n\_n\_d].
TF3 Series

- **Setting range:** 0 to 23 hour
- **Setting range:** 0 to 59 min
- **Setting range:** 0 to 100%

- **Night mode end hour**
- **Night mode end min.**
- **Temperature monitoring**
- **Comp. start-up delay time**
- **Comp. min. operation cycle**
- **Comp. min. operation time**
- **Comp. continuous operation**
- **Alarm delay time after continuous operation**
- **Comp. operation cycle when sensor break**
- **Comp. duty rate when sensor break**

※Appears for RTC function model.
※Does not appear when night mode [nMD] is set as [OFF, DI].

Setting range: OFF, S1, S2, S3, VS

---

**Temperature monitoring**

- **Setting range:** 0 to 24 hour

- **Comp. min. operation cycle**
- **Comp. min. operation time**
- **Comp. continuous operation**
- **Alarm delay time after continuous operation**
- **Comp. operation cycle when sensor break**
- **Comp. duty rate when sensor break**

Setting range: 0 to 60 min
Setting range: 0 (OFF) to 24 hour
Setting range: 0 to 100 min
Setting range: 0 to 100%

---

**Alarm delay time after continuous operation**

- **Setting range:** 2

---

**Comp. operation cycle when sensor break**

- **Setting range:** 0 to 59 min

---

**Comp. duty rate when sensor break**

- **Setting range:** 0 to 100%
Refrigeration Temperature Controller

Parameter 3 Group

1. Press any key among PS, S keys.
2. After entering setting mode, hold the (MODE) key anytime for 3 sec to return to RUN mode.
3. After entering setting mode, hold the (MODE) key anytime for 1.5 sec to go to the concerned group name.
4. If you press the (MODE) key after changing the set value of the parameter the set value will be stored.
5. Shaded parameters are for standard-level users, the others are for high-level users.
6. This parameter might not be displayed depending on other parameter settings or model specifications.

Setting range: In case of compressor output model, below parameters of parameter 3 group do not appear.

- Defrost cycle
  - Setting range: 0 to 24 hour/0 to 100 min
- Real-time defrost cycle: hour
  - Setting range: 0 to 23 hour, OFF
- Real-time defrost cycle: min
  - Setting range: 0 to 59 min, OFF
- Defrost time
  - Setting range: 1 to 100 min/1 to 100 sec
- Pump down delay time
  - Setting range: 0 min 00 sec to 9 min 59 sec
- Defrost end delay time
  - Setting range: -40 to 99°C, -40 to 212°F
- Defrost end temperature
  - Setting range: 1 to 5°C (0.5 to 5.0°C), 2 to 10°F (2.0 to 10.0°F)

PW code appears at SV display part for wrong PW

When PW is wrong

When PW is correct

Password input

You can set up to 8 real-time defrost cycles: hour, min.

Setting range: 0 to 24 hour/0 to 100 min

You can set up to 8 real-time defrost cycles: hour, min.

Setting range: 0 to 23 hour, OFF

Setting range: 0 to 59 min, OFF

Setting range: 1 to 100 min/1 to 100 sec

Setting range: 0 min 00 sec to 9 min 59 sec

Setting range: -40 to 99°C, -40 to 212°F

Setting range: 1 to 5°C (0.5 to 5.0°C), 2 to 10°F (2.0 to 10.0°F)
### Parameter 4 Group

1. **S**: Press any key among [S], [S], [S] keys.
2. After entering setting mode, hold the [MODE] key anytime for 3 sec to return to RUN mode.
3. After entering setting mode, hold the [MODE] key anytime for 1.5 sec to go to the concerned group name.
4. If you press the [MODE] key after changing the set value of the parameter the set value will be stored.
5. Shaded parameters are for standard-level users, the others are for high-level users.
6. (You can set the user level [USR] in parameter 5 group.)
7. This parameter might not be displayed depending on other parameter settings or model specifications.

#### Parameter 4 Group

- **Password Input**
  - PW code appears at SV display part for wrong PW.
  - When PW is wrong, PW code appears at SV display part for wrong PW.
  - When PW is correct, press 000.
  - 4 times

- **Alarm Operation Mode**
  - **R**
  - **Rd**
  - **OFF**

- **Alarm Option**
  - **R**
  - **RL**
  - **RL**
  - **RL**
  - **RL**

Setting range: In case of compressor output model, below parameters of parameter 4 group do not appear.

Setting range: **RL**, **RL**, **RL**, **RL**, **RL**, **RL**

When changing alarm option, **RL**, **RL**, **RL**, **RL** parameter values are reset.
Refrigeration Temperature Controller

- Alarm high-limit deviation
  - Setting range: -F.S. to F.S

- Alarm low-limit deviation
  - Setting range: 0 to 60 min

- Alarm hysteresis

- Alarm ON delay time

- Alarm OFF delay time

- External alarm delay time

- Alarm output method

- Evaporator-fan operation

- Evaporator-fan control temperature
  - Setting range: -40 to 99°C, -40 to 212°F

- Evaporator-fan hysteresis

- Evaporator-fan mode

- Evaporator-fan start-up delay time
  - Setting range: 0 min 00 sec to 9 min 59 sec
Parameter 5 Group

1. Press any key among $\text{PS}$ $\text{PS}$ $\text{PS}$ keys.
2. After entering setting mode, hold the $\text{(MODE)}$ key anytime for 3 sec to return to RUN mode.
3. After entering setting mode, hold the $\text{(MODE)}$ key anytime for 1.5 sec to go to the concerned group name.
4. If you press the $\text{(MODE)}$ key after changing the set value of the parameter the set value will be stored.
5. Shaded parameters are for standard-level users, the others are for high-level users.
6. (You can set the user level [$\text{USR}$] in parameter 5 group.)
7. This parameter might not be displayed depending on other parameter settings or model specifications.

- PW code appears at SV display part for wrong PW
- When PW is correct + 5 times
- When PW is wrong 2 sec
- 'PS' 000
- Parameter 5 group
- Current hour
- Current minute
- Digital input
- Loop break alarm monitoring time
- Comm. address
- Comm. speed
- Comm. parity bit
- Comm. stop bit
- Comm. response wait time
- Comm. write

Setting range:
- $\text{CUR}$ Random hour: 0 to 23 hour
- $\text{CUN}$ Random min: 0 to 59 min
- $\text{PS}$ Setting range: 0 to 23 hour
- $\text{PS}$ Setting range: 0 to 59 min
- $\text{PS}$ Setting range: 01 to 99
- $\text{PS}$ Setting range: 0 to 100
- $\text{PS}$ Setting range: 01 to 99
- $\text{PS}$ Setting range: 24, 48, 96, 192, 384
- $\text{PS}$ Multiply SV $\times$ 100 to read.
- $\text{PS}$ Setting range: OFF, $\text{STP}$, $\text{dSW}$, $\text{nMD}$, $\text{eAL}$, $\text{eDF}$, $\text{mDF}$

- $\text{COW}$ Setting range: 0, 1, 2, 3
- $\text{COW}$ Setting range: 20, 40, 60, 80
- $\text{COW}$ Setting range: 0 to 99ms
- $\text{COW}$ Setting range: 0 to 99

※ Appears only for RTC function model.

※ Appears only for RS485 communication model.

H-16
## Parameter Reset

Hold **[Hold]** keys for 5 sec to reset all parameters in memory to default value.

Set **[INI]** parameter to **[YES]** to reset all parameters.

In case password function is ON, it is required to enter valid password to reset parameters. Password is also reset.
TF3 Series

Front Panel Display When Power Is On

When power supplies to the unit, whole display part flashes approx. 1 sec. The display part displays model specification (no. of input CHs, output, power supply, compressor load capacity, option function), flashes input type twice and the unit returns to RUN mode to operate. Model specification display is same as the unit model name. (E.g.: TF33-34A-A model)

1. Whole display part
2. Series
3. No. of input CHs/Output/Power supply
4. Compressor load capacity/Option function
5. Run mode

SV Setting

You can set the temperature to control with the [↑], [↓], [←] keys. Set range is within SV low-limit value \([S\text{V}_L]\) to SV high-limit value \([S\text{V}_H]\).

E.g.) In case of changing SV from 19°C to 10°C

1. Press any key among the [↑], [↓], [←] in RUN mode to enter into SV setting mode. Last digit (10³ digit) on SV display part flashes.

2. Press the [↑] key to move digit. \((10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0)\)

3. Press the [↓] [←] key to raise or lower the set value. \((9 \rightarrow 0)\)

4. Press the [MODE] (MODE) key to save the set value. (If there is no additional key operations in 3 sec, the changed SV is automatically saved.)

Input Type and Range

<table>
<thead>
<tr>
<th>Input type</th>
<th>Decimal point</th>
<th>Display method</th>
<th>Temperature range (°C)</th>
<th>Temperature range (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermistor</td>
<td>NTC 5kΩ</td>
<td>nSL</td>
<td>-40 to 99</td>
<td>-40 to 212</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>hSL</td>
<td>-40 to -20</td>
<td>-40 to -20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-19.9 to 99.9</td>
<td>-100 to 212</td>
</tr>
<tr>
<td>NTC 10kΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>nLH</td>
<td>-40 to 99</td>
<td>-40 to 212</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>hL</td>
<td>-40 to -20</td>
<td>-40 to -20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-19.9 to 99.9</td>
<td>-100 to 212</td>
</tr>
<tr>
<td>RTD (2^\circ)</td>
<td>DPt 100Ω</td>
<td>dPM</td>
<td>-99 to 99</td>
<td>-148 to 212</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>dPL</td>
<td>-99 to -20</td>
<td>-148 to 212</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-19.9 to 99.9</td>
<td>-148 to 212</td>
</tr>
</tbody>
</table>

※TF3 Series displays only 3 digits. If PV decimal number of shaded temperature range is out of 3 digit, TF3 does not display the numbers below decimal point. You can check it at the comprehensive device management program (DAQMaster) by communicating via PC.

※1: Only for 1CH input model (TF31-□□□□)

※2: If PV with "-" sign is over 3 digits (e.g.: -99.9), the numbers below decimal point does not display. You can check it at the comprehensive device management program (DAQMaster) by communicating via PC.
## Refrigeration Temperature Controller

### Factory Default

#### SV setting \([S_U]\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>(S_U)</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Parameter 0 group

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>(dPb)</td>
<td>51</td>
</tr>
<tr>
<td>(nak)</td>
<td></td>
</tr>
</tbody>
</table>

#### Parameter 1 group \([P_{AR \_1}]\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a^b)</td>
<td></td>
</tr>
<tr>
<td>(nSH)</td>
<td>--</td>
</tr>
<tr>
<td>(S^b)</td>
<td>0</td>
</tr>
<tr>
<td>(S^3)</td>
<td>d(S^3)</td>
</tr>
<tr>
<td>(u)</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Parameter 2 group \([P_{AR \_2}]\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>(aFb)</td>
<td></td>
</tr>
<tr>
<td>(HS^5)</td>
<td></td>
</tr>
<tr>
<td>(aF5)</td>
<td>0</td>
</tr>
<tr>
<td>(HS^u)</td>
<td>95</td>
</tr>
<tr>
<td>(LS^u)</td>
<td>-40</td>
</tr>
<tr>
<td>(n)</td>
<td></td>
</tr>
</tbody>
</table>

#### Parameter 3 group \([P_{AR \_3}]\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>(d^E)</td>
<td></td>
</tr>
<tr>
<td>(I)</td>
<td></td>
</tr>
<tr>
<td>(nSH)</td>
<td>--</td>
</tr>
<tr>
<td>(d^E)</td>
<td>100</td>
</tr>
<tr>
<td>(Edc)</td>
<td>4</td>
</tr>
<tr>
<td>(d^h)</td>
<td></td>
</tr>
</tbody>
</table>

#### Parameter 4 group \([P_{AR \_4}]\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>(RL)</td>
<td></td>
</tr>
<tr>
<td>(RL^e)</td>
<td></td>
</tr>
<tr>
<td>(RL^h)</td>
<td>139</td>
</tr>
<tr>
<td>(RLL)</td>
<td>139</td>
</tr>
</tbody>
</table>

#### Parameter 5 group \([P_{AR \_5}]\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory default</th>
</tr>
</thead>
<tbody>
<tr>
<td>(C^UH)</td>
<td></td>
</tr>
<tr>
<td>(C^U)</td>
<td></td>
</tr>
<tr>
<td>(d^l)</td>
<td></td>
</tr>
<tr>
<td>(Lb^R)</td>
<td></td>
</tr>
</tbody>
</table>

---

**Autonics**
TF3 Series

**Alarm (Except 1CH, Compressor Output Model: TF31-1H)**

Set both alarm operation and alarm option by combining. Alarm function is available for compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3-2□□□□). Also defrost/auxiliary output [5.dR] of parameter 1 group should be set as auxiliary [RU5], and auxiliary output [RU5] should be set as alarm [RL].

In case of compressor+defrost+auxiliary (alarm/evaporator-fan) output model (TF3-3□□□□), auxiliary output [RU5] of parameter 1 group should be set as alarm [RL].

© Alarm operation [RL]

<table>
<thead>
<tr>
<th>Mode</th>
<th>Name</th>
<th>Alarm operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>—</td>
<td>—</td>
<td>No alarm output.</td>
</tr>
<tr>
<td>RLd</td>
<td>Deviation high, low-limit alarm</td>
<td>ON H OFF H ON</td>
<td>If deviation between present value (PV) and setting value (SV) is higher than high-limit or low-limit deviation SV, alarm output turns ON.</td>
</tr>
</tbody>
</table>

※ H: alarm output hysteresis [RLH]

© Alarm option [RLH]

<table>
<thead>
<tr>
<th>Mode</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLa</td>
<td>Standard alarm</td>
<td>If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.</td>
</tr>
<tr>
<td>RLb</td>
<td>Alarm latch ※1</td>
<td>If it is an alarm condition, alarm output is ON and maintains ON status.</td>
</tr>
<tr>
<td>RLC</td>
<td>Standby sequence 1</td>
<td>First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, the first alarm condition is ignored and from the second alarm condition, standard alarm operates.</td>
</tr>
<tr>
<td>RLd</td>
<td>Alarm latch and standby sequence 1</td>
<td>If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.</td>
</tr>
<tr>
<td>RLE</td>
<td>Standby sequence 2</td>
<td>If it is an alarm condition, it operates both alarm latch and standby sequence. When re-applied standby sequence ※2 and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.</td>
</tr>
<tr>
<td>RLF</td>
<td>Alarm latch and standby sequence 2</td>
<td>Basic operation is same as alarm latch and standby sequence 1. It operates not only by power ON/OFF, but also alarm set value, or alarm option changing. When re-applied standby sequence ※2 and if it is alarm condition, alarm latch operates.</td>
</tr>
</tbody>
</table>

※1: To clear alarm, turn OFF the power (also digital input [d1] is set as RUN/STOP [5.dP] and input is ON for pausing compressor output) or press the front [ key once. (press twice when buzzer is set)

※2: Condition of re-applied standby sequence for standby sequence: Power ON, changing temperature, alarm settings, switching STOP mode to RUN mode (also digital input [d1] is set as RUN/STOP [5.dP] and input turns OFF from ON for operation mode by releasing pause compressor output)
## Functions

### © Compressor protection

This function is for preventing compressor from life cycle shortening or malfunction by overload and frequent ON/OFF of compressor. As compressor protection settings, when compressor output does not ON, the front compressor (COMP) output indicator (green) is flashing.

- **Compressor start-up delay time \([S_{dl}]\)**
  If power turns ON instantly from break-down or power OFF, it delays start-up during the set time of compressor.
  Setting range: 0 to 60 (min)

- **Compressor restart delay time \([r_{dl}]\)**
  To prevent frequent compressor ON/OFF, set compressor ON time after compressor turns OFF.
  Setting range: 0 to 60 (min)

- **Compressor min. operation time \([n_{tb}]\), compressor min. operation cycle \([C_{yc}]\)**
  To prevent frequent compressor ON/OFF, set min. operation time and min. operation cycle.
  Setting range of compressor min. operation time: 0 to 60 (min),
  Setting range of compressor min. operation cycle: 0 to 60 (min)

![Compressor operation cycle diagram](image.png)

- **ON rate (50%)**
- **Operation cycle (60 min)**
- **Comp. output**
- **SV**
- **Temp.**
- **Compressor start-up delay time**
- **Compressor restart delay time**
- **Compressor min. operation cycle**
- **Compressor restart delay time**
- **Compressor min. operation cycle**
- **Compressor min. operation cycle**
- **Hysteresis**

※1: When starting compressor, if present value (PV) is out of hysteresis range, compressor output does not turn ON and the compressor (COMP) output indicator is flashing during compressor start-up delay time.

※2: When compressor delay is completed and it is within compressor min. operation cycle, compressor output does not turn ON and the compressor (COMP) output indicator is flashing. (The latest one has priority between compressor restart delay time and compressor min. operation cycle.)

※3: When present value (PV) is out of hysteresis, compressor output does not turn ON and the compressor (COMP) output indicator is flashing. (The latest one has priority between compressor restart delay time and compressor min. operation cycle.)

※4: If present value (PV) is below the SV, compressor output maintains ON status during compressor min. operation time. After compressor min. operation time, it turns OFF.

※If compressor output does not turn ON due to compressor output condition or parameter settings for compressor protection, the compressor (COMP) output indicator is flashing.

★For more information about parameters for compressor prevention, refer to user manual.

### © Compressor control when sensor break

If normal temperature control is impossible due to sensor break, it controls compressor output by the set operation cycle and duty ratio to protect control object. Until error is cleared, operation cycle and duty ratio are applied repeatedly. When error is cleared, the compressor operates after completing the currently applied operation cycle and compressor restart delay time.

- **Compressor operation cycle when sensor break \([C_{LE}]\)**
  Set compressor operation cycle when sensor break.
  Set as \([C]\) and compressor output turns OFF when sensor break.
  Setting range: 0 to 100 (min)

- **Compressor duty ratio when sensor break \([d_{Ut}]\)**
  Set compressor ON duty ratio when sensor break.
  Setting range: 0 to 100 (%)

**E.g.** When compressor operation cycle when sensor break \([C_{LE}]\)
 is set as 60 min and compressor duty ratio when sensor break \([d_{Ut}]\) is set as 50%, compressor output has 60 min cycle and turns ON for 30 min and turns OFF for 30 min.
Defrost control (except 1CH, compressor output model: TF31-1□□)

When operating a compressor for a long time, an evaporator and a freezer are freezing and thermal efficiency of compressor is decreased. For increasing thermal efficiency, defrost operation helps to remove frost or ice around of evaporator.

Set defrost cycle, time, and end temperature, etc to operate defrost (heater/hot-gas defrost).

The front defrost (DEF) output indicator (green) turns ON during defrost output and it flashes during defrost delay operation.

In case of compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□-2□□□□), defrost operation is available when defrost/auxiliary output [SF] of parameter 1 group is set as defrost [DEF].

### Defrost method and operation [DEF]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Defrost method</th>
<th>Defrost operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>He Ε h</td>
<td>Heater defrost</td>
<td>Operates during the set defrost cycle/time</td>
</tr>
<tr>
<td>Gt Ε n</td>
<td>Hot-gas defrost</td>
<td>Operates when PV is lower than defrost end temperature during the set defrost cycle/time (only for 3CH input model (TF33-□□□□))</td>
</tr>
</tbody>
</table>

- **Defrost cycle [di n], defrost time [dEt]**
  - Set defrost cycle and time to operate defrost at every set cycle and during the set time.
  - Defrost cycle setting range: 0 to 24 (hour)/0 to 100 (min)
  - Defrost time setting range: 1 to 100 (min/sec)

- **Defrost end temperature [Edt], Defrost hysteresis [dHY]**
  - Set defrost end temperature and defrost hysteresis from input sensor 2 (defrost temperature). When the measured temperature of defrost sensor is same as the set defrost end temperature, defrost operation is stopped.
  - Available when input sensor 2 ON/OFF [S2] is set as [ON] and defrost method and operation [DEF] is set as [hTt] or [gTt].

- **Defrost synchronization** (only for synchronize defrost function model: TF33-□□□□-□□, RS485 communication model: TF33-□□□□-A-T/A)
  - When connecting over 2 units of TF3, defrost and compressor operation is able to synchronize via synchronize terminal/RS485 communication.
  - Available for synchronize defrost function model (TF33-□□□□-□□), or RS485 communication model (TF33-□□□□-A-T/A).

  **Setting Order**
  1. Connect each other synchronize terminals or RS485 communication terminals of the units which are synchronized for defrost.
  2. Set defrost cycle [di n] same as among the units. (if error occurs, defrost cycle is the setting of each unit)
  3. Set defrost group [dGn] as 1 master unit [nARS] and slave unit (s) (up to 5 units) [SL R].
  4. According to defrost operation of Master, the defrost operation of slave(s) executes. (changing the defrost parameters of master, defrost operations of slave(s) are also changed forcibly as same as the defrost operation of master via connected terminals. The defrost parameters of slave(s) are not changed.)

- **Manual defrost**
  - Execute defrost manually regardless of the set defrost cycle which consists of defrost method and operation setting. Hold the front key over 3 sec or, turn ON the digital input when digital input [DI] of parameter 5 group is set as [mDF] to operate defrost during the set defrost time.
  - The front defrost (DEF) output indicator turns ON for 2 sec and turns OFF for 1 sec during manual defrost. Hold the front key over 3 sec or turn OFF the digital input during manual defrost, and the set defrost cycle re-starts.

- **Defrost synchronization** (only for synchronize defrost function model: TF33-□□□□-□□, RS485 communication model: TF33-□□□□-A-T/A)
  - When connecting over 2 units of TF3, defrost and compressor operation is able to synchronize via synchronize terminal/RS485 communication.

  **For more information about parameters for defrost operations, refer to user manual.**
© Evaporator-fan control (except 1CH, compressor output model: TF31-1□□)

To improve the efficiency of cooling, install and control evaporator-fan at evaporator. It is available for compressor+defrost or auxiliary (alarm/evaporator-fan) output model (TF3□□-□□). Also defrost/auxiliary output turns OFF. Set evaporator-fan control temperature \[\text{fHY} \text{℃} \text{ or ℉} \].

- Evaporator-fan operation \[\text{EF} \text{-□□} \]
  Evaporator-fan operates by two control methods; \[\text{EF} \text{-□□} \] controls evaporator-fan by measured temperature from defrost sensor or \[\text{fRn} \] controls evaporator-fan by compressor/defrost operation.

- Evaporator-fan control temperature \[\text{fHY} \text{℃ or ℉} \] and hysteresis \[\text{fHY} \text{℃ or ℉} \]
  When evaporator-fan operation \[\text{EF} \text{-□□} \] is set as \[\text{EF} \text{-□□} \] controls evaporator-fan controlled by measured temperature from defrost sensor, and the temperature of defrost sensor is same as evaporator-fan control temperature \[\text{fHY} \text{℃ or ℉} \]. evaporator-fan output turns OFF. Set evaporator-fan control temperature \[\text{fHY} \text{℃ or ℉} \] and evaporator-fan control hysteresis \[\text{fHY} \text{℃ or ℉} \].

- Evaporator-fan operation mode \[\text{fRn} \] and evaporator-fan start-up delay time \[\text{pDR} \text{min} \text{ or sec} \]
  When evaporator-fan operation \[\text{EF} \text{-□□} \] is set as \[\text{fRn} \] for control by compressor/defrost operation, it is available to set \[\text{fRn} \] for evaporator-fan operation mode for compressor/defrost operation.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Operation method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EF 1</strong></td>
<td>When compressor operates, evaporator-fan also operates. When compressor operation is finished, evaporator-fan also operation turns OFF. (except compressor operation for hot gas defrost)</td>
</tr>
<tr>
<td><strong>EF 2</strong></td>
<td>When compressor operates, evaporator-fan operates after the set evaporator-fan start-up delay time. When compressor operation is finished, evaporator-fan operation turns OFF. (regardless of defroster operation)</td>
</tr>
<tr>
<td><strong>EF 3</strong></td>
<td>When power turns ON, evaporator-fan operates. When defroster operates, evaporator-fan stops. (regardless of compressor operation)</td>
</tr>
<tr>
<td><strong>EF 4</strong></td>
<td>Evaporator-fan operates only when operating compressor or defrost. Evaporator-fan stops when compressor and defroster stops. (for above zero temperature control)</td>
</tr>
<tr>
<td><strong>EF 5</strong></td>
<td>Evaporator-fan operates from power ON to power OFF. (regardless of defroster operation of freezer. When door is open (digital input [\text{dSW} ]) is set as RUN/STOP [\text{fHY} \text{℃ or ℉} ] or door switch [\text{dSW} ]), evaporator-fan stops.</td>
</tr>
</tbody>
</table>

- If evaporator temperature is increased by defrost operation, warm air may flow into cooling system by evaporator-fan operation. Set evaporator-fan start-up delay time \[\text{pDR} \text{min or sec} \] to prevent warm air inflow, and it may increase cooling efficiency. Evaporator-fan start-up delay time setting range: 0.00 to 9.59 (0 min 00 sec to 9 min 59 sec)

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※: Output does not turn ON but the dedicated indicator flashes at the delay period (compressor, defrost, evaporator-fan).

★For more information about parameters for evaporator-fan control, refer to user manual.

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**Refrigeration Temperature Controller**

(A) Photoelectric Sensors
(B) Fiber Optic Sensors
(C) Door/Area Sensors
(D) Pressure Sensors
(E) Rotary Encoders
(F) Connectors/Connector Cable/Access Distribution Break/Sockets
(G) Temperature Controllers
(H) SSRs / Power Controllers
(I) Counters
(J) Timers
(K) Panel Meters
(L) Display Units
(M) Tacho / Speed / Pulse Meters
(N) Sensor Controllers
(P) Switching Mode Power Supplies
(Q) Stepper Motors & Drivers & Controllers
(R) Graphic / Logic Panels
(S) Field Network Devices
(T) Software
Digital input [DI]

Digital input is available only for 3CH input model (TF33-3CH-□). Also input sensor 3 selection [S3] should be set as digital input [DI].

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>RUN/STOP</td>
<td>STP</td>
</tr>
<tr>
<td>Door switch</td>
<td>dS</td>
</tr>
<tr>
<td>Night mode ON/OFF</td>
<td>nMd</td>
</tr>
<tr>
<td>External alarm</td>
<td>eAL</td>
</tr>
<tr>
<td>Defrost ON/OFF</td>
<td>eDF</td>
</tr>
<tr>
<td>Manual defrost</td>
<td>mDF</td>
</tr>
<tr>
<td>Virtual temperature rate</td>
<td><img src="Virtual_temperature_rate_formula" alt="Formula" /></td>
</tr>
<tr>
<td>Display selection</td>
<td><img src="Selected_input_sensor" alt="Table" /></td>
</tr>
<tr>
<td>Parameter mask</td>
<td>This function is able to hide unnecessary parameters to user environment or less frequently used parameters in parameter group. You can set this in the comprehensive device management program (DAQmaster). Masked parameters are only not displayed. The setting value of masked parameters are applied. For more information, refer to DAQMaster user manual. Visit our web site (<a href="http://www.autonics.com">www.autonics.com</a>) to download DAQmaster program and the user manual.</td>
</tr>
</tbody>
</table>

Virtual temperature rate ![Formula](Virtual_temperature_rate_formula)

In case of 3CH input model (TF33-3CH-□), input sensor 3 selection [S3] of parameter 1 group is set as outlet temperature [□]. You can set virtual temperature rate.

If the temperature of inlet and outlet is significantly different at freezer, virtual temperature helps to control temperature efficiently.

Virtual temperature is designated by the rate of input sensor 1 (inlet temperature) and input sensor 3 (outlet temperature).

There is virtual temperature calculation formula:

\[
\text{Virtual temperature (PV)} = \frac{[100 - \text{virtual temperature rate}] \times \text{input sensor 1 temperature} + \text{virtual temperature rate} \times \text{input sensor 2 temperature}}{100}
\]

If virtual temperature rate is set as [□], virtual temperature (PV) = input sensor 1.

If virtual temperature rate is set as [□], virtual temperature (PV) = input sensor 3.

E.g.) If inlet temperature of input sensor 1 is 0°C, and outlet temperature of input sensor 3 is 10°C, set virtual temperature rate as [□] and virtual temperature is 5°C to control temperature.

\[
5 = \frac{[100 - 50] \times 0 + 50 \times 10}{100}
\]

Setting range of virtual temperature rate: 0 to 100 (%)

Display selection ![Table](Selected_input_sensor)

You can select input sensor to display at present value (PV) display component in RUN mode.

Parameter mask

This function is able to hide unnecessary parameters to user environment or less frequently used parameters in parameter group. You can set this in the comprehensive device management program (DAQmaster).

Masked parameters are only not displayed. The setting value of masked parameters are applied.

For more information, refer to DAQMaster user manual.

Visit our web site (www.autonics.com) to download DAQmaster program and the user manual.

Before applying mask

After applying mask

The above is masking input sensor 3 selection [S3], temperature unit [□] of parameter 1 group for 3CH input model (TF33-3CH-□).
© Parameter user group [PAU]

This function is able to set the frequently used parameters to the user parameter group. You can quickly and easily set parameter settings. User parameter group can have up to 30 parameters in the comprehensive device management program (DAQMaster).

For more information, refer to the DAQMaster user manual.

Visit our web site (www.autonics.com) to download the DAQMaster program and the user manual.

RUN mode

The above is setting user parameter group in the DAQMaster with delay display period [DsT] of parameter 1 group, hysteresis [HYS], night mode hysteresis [nHY] of parameter 2 group, defrost method [DEF], defrost time [DET] of parameter 3 group, alarm output hysteresis [aHY] of parameter 4 group.

© Communication output

It is for parameter setting and monitoring via external devices (PC, PLC, etc.).

- Interface

<table>
<thead>
<tr>
<th>Comm. protocol</th>
<th>Modbus RTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection type</td>
<td>RS485</td>
</tr>
<tr>
<td>Application standard</td>
<td>Compliance with EIA, RS485</td>
</tr>
<tr>
<td>Max. connection</td>
<td>31 units (address: 01 to 99)</td>
</tr>
<tr>
<td>Synchronous method</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Comm. method</td>
<td>Two-wire half duplex</td>
</tr>
<tr>
<td>Comm. distance</td>
<td>Max. 800m</td>
</tr>
</tbody>
</table>

※ It is not allowed to set overlapping communication address at the same communication line.

Use twisted pair wire for RS485 communication.

- Application of system organization

  ※ It is recommended to use Autonics communication converter; SCM-WF48 (Wi-Fi to RS485-USB wireless communication converter, sold separately), SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately).

Please use twisted pair wire, which is suitable for RS485 communication, for SCM-WF48, SCM-US48I and SCM-38I.

Error Display

<table>
<thead>
<tr>
<th>Flashing in turn</th>
<th>Description</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eř[1][K]'Pn</td>
<td>When input sensor is break or sensor is disconnected.</td>
<td>Check input sensor status.</td>
</tr>
<tr>
<td>Eř[1][L][LL]</td>
<td>If the measured temperature of the dedicated sensor is lower than low-limit temperature among temperature setting range.</td>
<td>It clears when input is within the display range.</td>
</tr>
<tr>
<td>Eř[1][H][HH]</td>
<td>If the measured temperature of the dedicated sensor is higher than high-limit temperature among temperature setting range.</td>
<td>Check the compressor and hold the [][] key at the same time for 3 sec. It clears when input is within the adequate range.</td>
</tr>
<tr>
<td>Eř[1][L][B]</td>
<td>Even though input sensor is normal, freezer temperature does not change over 1.0°C (1.8°F) during loop break alarm monitoring time [L BR].</td>
<td>Check input sensor status.</td>
</tr>
</tbody>
</table>

※1: [□] indicates input sensor number of error display priority which occurs error.


※2: Eř[u] (virtual temperature) is not applicable.
Proper Usage

Cautions during use

- Follow instructions in 'Cautions during use'. Otherwise, it may cause unexpected accidents.
- Check the polarity of the terminals before wiring the temperature sensor.
  For RTD temperature sensor, wire it as 3-wire type, using cables in same thickness and length.
  For thermocouple (CT) temperature sensor, use the designated compensation wire for extending wire.
- Keep away from high voltage lines or power lines to prevent inductive noise.
  In case installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line.
- Do not use near the equipment which generates strong magnetic force or high frequency noise.
- Do not apply excessive power when connecting or disconnecting the connectors of the product.
- Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
- Do not use the unit for other purpose (e.g. voltmeter, ammeter), but temperature controller.
- 24VAC, 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Make a required space around the unit for radiation of heat.
  For accurate temperature measurement, warm up the unit over 20 min after turning on the power.
- Install a surge absorber at each end of inductive load coil when controlling high-capacity power relay or inductive load (e.g. magnet).
- Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.
- Do not wire to terminals which are not used.
- This unit may be used in the following environments.
  ① Indoors (in the environment condition rated in 'Specifications')
  ② Altitude max. 2,000m
  ③ Pollution degree 2
  ④ Installation category II