Advanced 4-Output Refrigeration Controller with Integrated 3 Digit LED Display

# FTO42C User Instructions

## 1. Overview

The FTO42C is an advanced refrigeration controller complete with integrated 3-digit LED display. It provides 4 independent outputs designed to provide temperature, defrost and lighting control along with energy saving. The FTO42C provides a highly configurable system, accessed via a menu structure on the display, enabling the user to rapidly tailor the system behaviour to their requirements.

## 2. Device Functions

### *2.1. Temperature control*

The FTO42C senses the cooler temperature by means of a temperature probe. The cooler temperature is determined by measuring the temperature of either the return airflow or evaporator temperature depending on where the customer prefers to fit the probe.

### *2.2. Energy saving*

Energy saving mode, if enabled, is entered either when the door has been closed for a certain number of hours, as monitored by the door switch sensor, or when the energy-save button ("STAR") is pressed. During energy saving mode the temperature set-points are set to higher limits than they are in normal mode, so the regulated temperature will be higher and less cooling demand will be required of the compressor. This results in energy saving due to the compressor being off for longer periods of time. The menu provides flexibility to enable/disable the energy saving feature, set the number of energy saving levels (maximum of 3), the temperature limits for each level and set the duration of the energy saving. Also, during energy saving mode, the lights can switch off to save more energy, which is adjustable via the menu too.
Energy saving mode is exited when the door is opened more than twice per half an hour, or if the energy-save "STAR" button is pressed.
The green energy saving LED will illuminate when the unit is in energy saving mode and turn off when the energy saving is not active.
Energy saving can be inhibited during pull-down period (customer specified).

### *2.3. Defrost capabilities*

Defrost, if enabled, can be activated either when the evaporator temperature drops below a certain temperature or after a certain number of hours, either real time, compressor accumulated run-time or compressor continuous run-time. Defrost can be exited either when the evaporator temperature rises above a certain temperature or after a certain number of minutes. During defrost, the compressor and the evaporator fan switch off while the defrost heater (if exists) switches on.
The menu provides flexibility to enable/disable the defrost function, sets the defrost interval, defrost duration, defrost terminate temperature, and enable/disable operating the heater output.
Defrost can be inhibited during pull-down period, and while the controller is in energy saving mode (customer specified).

### *2.4. Voltage protection*

The FTO42C continuously senses the incoming mains supply, and if configured as such, will disconnect all the outputs when the mains voltage or frequency is higher or lower than acceptable limits. The FTO42C reconnects the supply automatically after it returns to within normal limits after a pre-set time delay.
The high and low voltage limits can be adjustable via the menu.

### 2.5. Condenser temperature monitoring

If enabled, the FTO42C continuously monitors the condenser temperature via the second temperature probe "Probe2". The compressor and the fan will switch off when the condenser temperature goes above Condenser High Temperature, and will stay off until the condenser temperature drops below Condenser Low Temperature.
Also, visual and audible alarms can be initiated upon condenser high temperature (customer specified).

### 2.6. Door activation monitoring

The FTO42C monitors the activation of the cooler door by means of a switch that is connected to the FTO42C unit. Every time the door opens, the fan switches off, staying off as long as the door is open. The fan will come on again after the door is closed, providing that the compressor is already on. A delay can be provided for the fan to come on after the door is closed, and the duration of this delay is customer specified.
If the door stays open for longer than 2 minutes, the compressor will turn off as well, and will not re-connect until the door is closed and the intelligent time delay is over. This duration can be adjusted via the menu.
The unit logs the door activating in the past 2 weeks. Also, and the logging can be reset every time the unit starts up (customer specified).

### 2.7. Fan control

During normal operation the fan will stay on when the compressor cycles on, and the fan will cycle on and off when the compressor cycles off. The fan switches off every time the door is open, and switches on again after the door is closed, providing that the compressor is on at that time.
The fan switches off while the unit is in defrost mode, and it comes on one minute after the defrost finishes.
The on and off cycling durations of the fan and the delay to come on after defrost can be adjusted via the menu.

### 2.8. Lights control

The lights can be configured to switch off during energy saving mode via the menu to save more energy, and will come on again when energy saving is not active (or exited).

### 2.9. Buzzer alarm

The FTO42C is equipped with a buzzer which will start sounding when the door stays open for more than 5 minutes (value is customer specified). Whilst the buzzer is sounding, it could be muted by pressing and holding down the "STAR" button for 5 seconds. Also, the buzzer can sound upon any of the following incidents (customer specified):

- When there is a fault with Probe1.
- When there is a fault with Probe2.
- When the temperature sensed by the main probe (Probe1) is too high or too low.
- When the condenser temperature goes above a certain temperature.
- When the first pull-down takes too long (duration in hours is customer specified).

### 2.10. Temperature blind time

The FTO42C will ignore the sensor temperature reading for a short period after either the fan or the compressor is switched on. This is to prevent short-term thermal or interference effects such as those caused by a fan starting causing disconnection. The temperature blind time could be disabled or set to any value based on the customer requirement.

### 2.11. High voltage and low voltage blind time

The FTO42C permits high and low mains voltages transitions for short periods of time preventing inadvertent compressor stop-starts. However, if the mains voltage goes higher or lower than set extreme limits, then the FTO42C will immediately disconnect the outputs. The high and low voltage blind time could be disabled or configured separately to any value based on the customer requirement.

### 2.12. Intelligent time delay

In order to adequately protect the compressor, the FTO42C incorporates a built-in intelligent time delay of 3 minutes before the compressor can be re-activated after it has been switched off. This delay takes into account events such as power interruptions so for example a 1-minute power disconnection will result in only a 2-minute additional delay, making the total delay about 3 minutes. Any disconnection for 3 minutes or more will only result in a 10-second delay.

### 2.13. LEDs operation

The unit is equipped with 3 LEDs – Green, red and amber.
The green LED indicates the energy saving status – On when the unit is in energy saving mode.
The red LED indicates the compressor output status – On when the compressor output is On.
The amber LED indicates the fan output status – On when the fan output is On.

### 2.14. Restoring factory settings

The factory settings can be restored by pressing and holding down the bottom-right and bottom-left buttons during start-up. The green LED will flash quickly 5 times, then both the green LED and the buzzer will come On for about one second then Off. The unit will resume working normally after releasing the buttons.

***Note:***
Some of the menu items can be activated/deactivated and therefore enabling/disabling configuring some of the system operational parameters based on the customer requirement.

## 3. LED Digital Display Quick Guide

The digital display of the FTO42C is used to perform the following functions:

- Display of current temperature being measured by the FTO42C unit.
- Display of various alarms that may arise during the operation of the FTO42C unit.
- Built-in menu to display and modify some parameters and variables of the FTO42C unit.

### *3.1. Operational Alarms*

The FTO42C displays various alarms, based on the operational conditions.

In normal mode, the display shows the temperature that is being measured. During alarm conditions, the temperature will alternate with one or more alarm indications on the display.

A list of the available alarm codes and their meanings is listed below:

| Displayed Alarm | Description |
|---|---|
| | |
| P1 | Probe 1 fault |
| P2 | Probe 2 fault |
| LP | Long Pull-down |
| CA | Condenser Alarm |
| CC | Condenser Cut-out |
| dO | Door Open |
| tH | Temperature High alarm |
| tL | Temperature Low alarm |
| Hu | High Voltage |
| Lu | Low Voltage |
| rF | Refrigeration Fault |

Table 1: FTO42C various alarms and their meanings

***Note:***

1. Various alarms can be enabled/disabled depending on the customer specification.
2. Pressing the ‘star’ button will enable/disable the Energy Saving mode. The small green LED will light if the unit is in Energy Saving mode. There could be some restrictions in initiating the Energy Saving mode based on the customer requirement.
3. Pressing the ‘start’ button and holding it down for 5 consecutive seconds will mute/unmute the audible alarm, if it exists.
4. Pressing the ‘tick’ button and holding it down for 5 consecutive seconds will show the number of door openings for the past 14 days. To go back to normal mode, press any of the four buttons, or the unit will go back automatically after 20 seconds.

### *3.2. Menu Items*

The FTO42C unit has a built-in menu system, which enables access to and modification of many operational parameters of the FTO42C unit.

- To access the menu mode, a certain key combination has to be entered by pressing the buttons in the following sequence: 'UP', 'DOWN', 'UP', 'DOWN' and then 'TICK'.
- Upon entering the correct combination, the display will show the first menu item. Pressing the 'UP' and 'DOWN' buttons will allow you to move through all the different menu items.
- Pressing the 'TICK' button at any menu item will display the setting of that particular item. Some settings are 'read only', whilst others can be modified using the 'UP' and 'DOWN' buttons. Pressing the 'TICK' button again will save any changes and return back to the main menu mode.
- Pressing the 'STAR' button at any stage will leave the menu mode and return back to the normal mode.
- Whilst in menu mode, and if none of the buttons are pressed for 20 seconds, the unit will go back automatically to normal mode, and start displaying the temperature and various alarms if applicable.

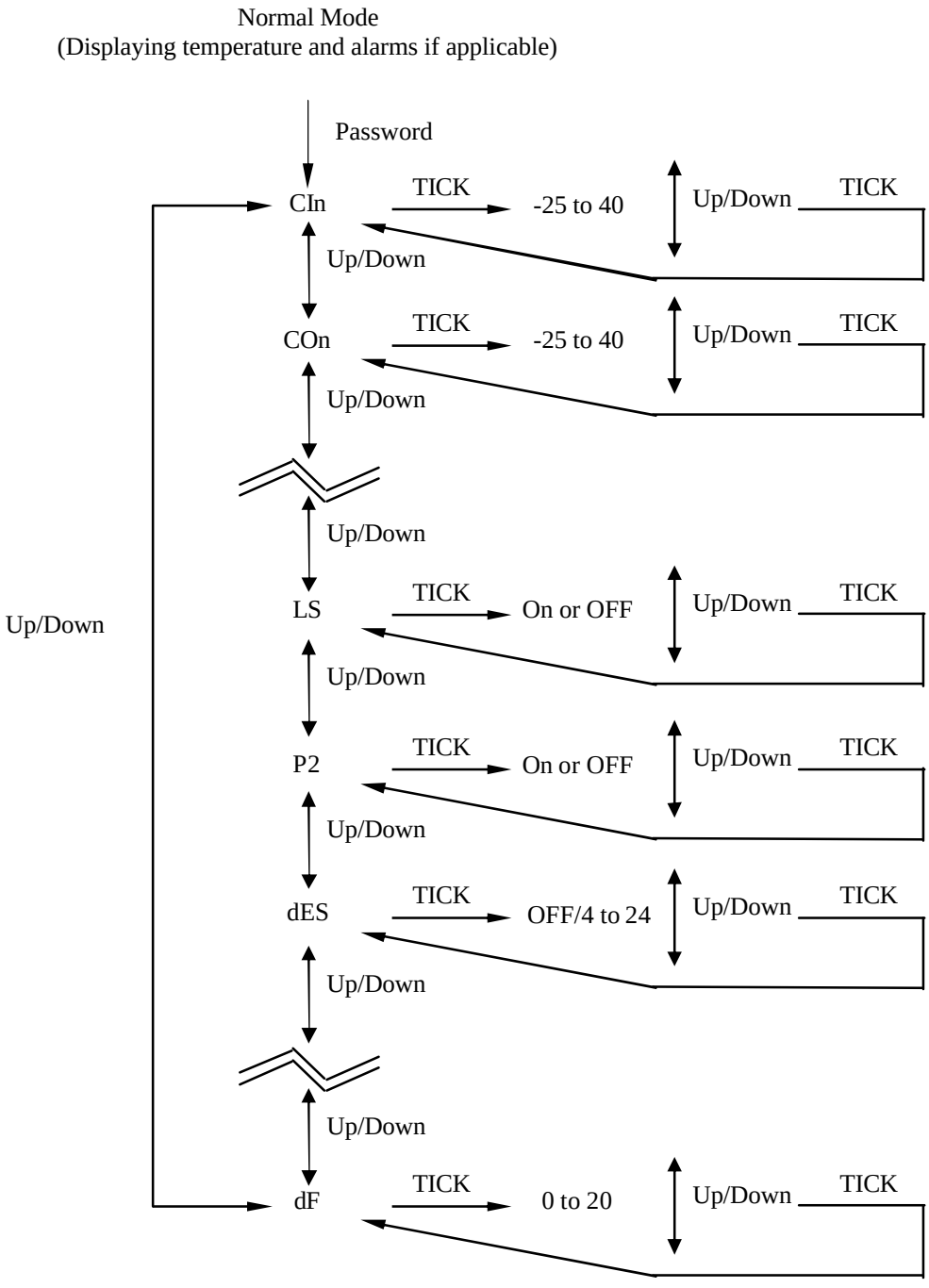



Figure 3: Viewing and editing FTO42C menu items

***Note:***
The actual menu order and content can be different than the one mentioned in the example above, this is just for illustration purposes.

A list of different menu items, their value ranges and meanings is listed below:

| Menu Item | Description | Data Range | Access Level |
|---|---|---|---|
| CIn | Normal mode Cut-In value in ºC | -25 to +40 | Read/Write |
| COn | Normal mode Cut-Out value in ºC | -25 to +40 | Read/Write |
| CIS | Energy Saving Level#1 Cut-In value in ºC | -25 to +40 | Read/Write |
| COS | Energy Saving Level#1 Cut-Out value in ºC | -25 to +40 | Read/Write |
| tH | High Temperature Alarm in ºC - start | -25 to +40 | Read/Write |
| tL | Low Temperature Alarm in ºC- start | -25 to +40 | Read/Write |
| CA | Condenser Alarm temperature in ºC | n/a | Read Only |
| Hu | High voltage disconnect limit | 280 to Lu | Read/Write |
| Lu | Low voltage disconnect limit | Hu to 60 | Read/Write |
| dO | Door Open Alarm Period (in minutes) | 3 to 50 | Read/Write |
| EON | Fan cycling On-time when compressor cycles Off (in minutes) | 1 to 45 | Read/Write |
| EOF | Fan cycling Off-time when compressor cycles Off (in minutes) | 1 to 45 | Read/Write |
| LP | Long Pull-down Duration (in hours) | 15 to 99 | Read/Write |
| rF | Refrigeration Fault Duration (in hours) | 2 to 12 | Read/Write |
| tES | Energy Saving Door Close Activation Period (in hours) | 1 to 99 | Read/Write |
| LS | Light Save during energy saving mode | On/OFF | Read/Write |
| P2 | 2nd Probe Enable/Disable Flag | On/OFF | Read/Write |
| dES | Energy saving duration (in hours) | OFF/4 to 24 | Read/Write |
| dEF | Defrost mode setting | OFF/nAt/HEA | Read/Write |
| Int | Defrost Interval (in hours) | 4 to 24 | Read/Write |
| dur | Defrost Duration (in minutes) | 10 to 30 | Read/Write |
| tFd | Defrost Terminate Temperature in ºC | 0 to 30 | Read/Write |
| dF | Defrost Delay Fan (post-defrost fan delay in minutes) | 0 to 20 | Read/Write |

Table 2: FTO42C various menu items and their meanings

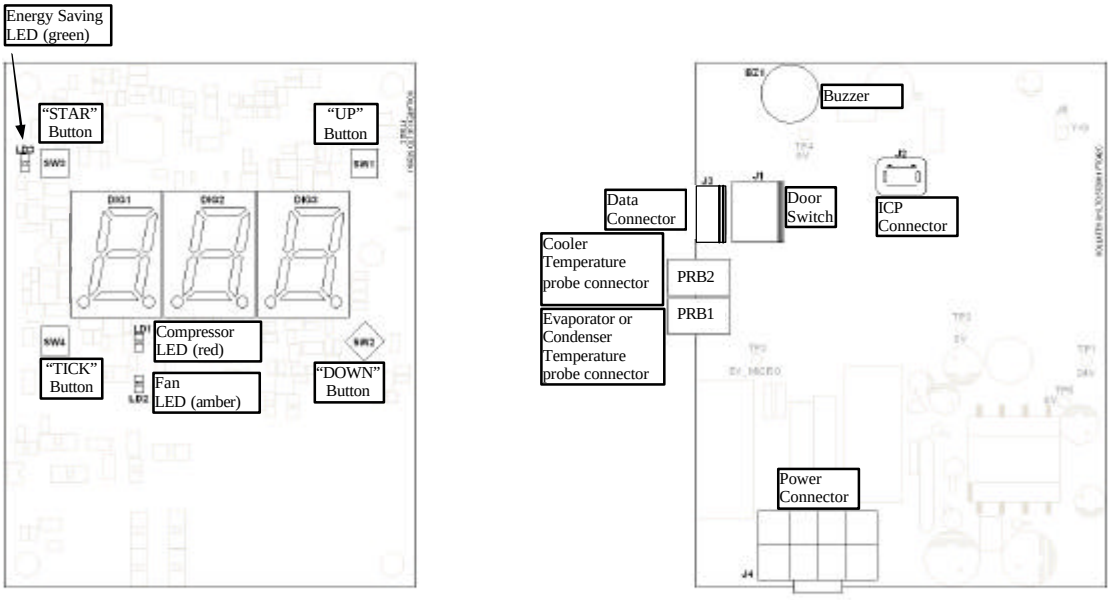
***Note:***

1. Various menu items can be disabled (invisible) depending on the customer requirement.

2. If menu item dES is set to OFF, then the unit will stay in ES mode until the door is open or the ES button is pressed. If set to any value between 4 and 24 hours, then the unit will only go into ES mode if the first pull-down even has taken place.

3. If menu item dEF is set to OFF, then defrost function will be disabled and menu items Int, dur, tFd and dF will not show. Setting dEF to nAt or HEA enables the defrost function, and the defrost heater output will come during defrost if dEF is set to HEA.

## 4. FTO42C Layout and Connections

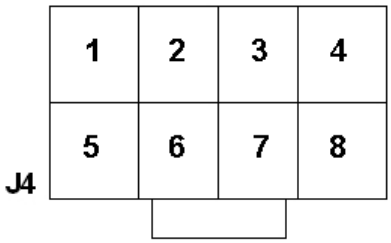



Front View Rear View

Figure 1: FTO42C Layout and Connector positions

### 1.1.1 Power Connector Pin-out Top View

To connect to J4, use JST part VLP-08V-1 with appropriate crimp connectors
SVF-42T-P2.0
SVF-61T-P2.0
SVF-81T-P2.0




| |
|---|
| 1: Live In. |
| 2: 16A Defrost heater output Live |
| 3: Neutral Connection |
| 4: 3A Lights output Live |
| 5: 16A Compressor output Live |
| 6: Neutral Connection |
| 7: Neutral Connection |
| 8: 3A Auxiliary output Live (evaporator fan). |

Figure 2: Power Connector J4 Wiring Diagram