FDC-C42 Chamber Controller

Installation – Setup – Operation - Service

1 Introduction

This new generation of low-cost, microprocessor-based control incorporates two bright, easy to read LCD displays which indicate process value (PV) and set point (SP). The control is powered by an 11-26 VDC supply and incorporates a 2 Amp control relay output as a standard. The control is fully programmable for **PT100 RTD and thermocouple types J, K, T, E, B, R, S, N, L, U, P, C, and D**. The input provides high accuracy via an 18-bit A to D converter and when coupled with the fast-sampling rate, allows control of fast processes.

1.1 Features

- LCD display
- Simple operation
- Universal input (thermocouple/RTD) with high accuracy 18-bit A-D conversion
- Fast sampling rate
- Degrees F or C operation
- Low voltage operation
- Programmable deadband alarm
- Power failure alarm
- Low battery indication
- Adjustable hysteresis for control and alarm outputs
- Process value calibration offset adjustment
- Control and alarm relay (SPST) output contacts
- Audible alarm with silence (utilizing external relay)

The FDC-C42 microprocessor-based controller, incorporates dual, easy to read 4-digit LCD readouts to indicate process value and set point, as well as other controller operations. The unit features keys to select the various operator views as well as control parameters. The FDC-C42 chamber controller is provided pre-configured, specifically for low temperature chamber operation, providing simple to use, “hassle” free operation for startup and operation of the chamber.

The FDC-C42 incorporates a (SPST) control relay output and three (SPST) alarm relay outputs. Two of the alarm relays (AL1 for temperature and AL2 for power failure) are prewired together in order to facilitate faster installation and connection to external alarm relays for remote indication and sounding the on-board audible alarm (wired separately). A programmable deadband alarm set point allows the operator to monitor/indicate alarm conditions above and below chamber operational settings.

The FDC-C42 provides digital inputs which are utilized for the power failure and low battery indicators (compatible with MEAN WELL DRC-40/60 series power supplies). When main power is lost, the external 12Vdc backup battery will maintain power to the FDC-C42; however, the “power OK” input will be deactivated causing the second alarm relay output (AL2) to activate and sound the audible alarm. A silence push-button is provided for the audible alarm, so that when a temperature and/or power failure alarm occurs, the operator can silence the alarm.

2 Installation

Dangerous voltages capable of causing death can be present within this instrument. Before performing installation or troubleshooting procedures, the power to the equipment must be switched off and isolated. Units suspected of being faulty must be disconnected and removed to a properly equipped workshop for test and repair. Component replacement and internal adjustments must be made by qualified maintenance personnel only.

To minimize the possibility of fire or electrical shock hazards, do not expose this instrument to rain or excessive moisture.

This equipment is designed for installation in an enclosure which provides adequate protection against electric shock. The enclosure must be connected to earth ground.

Do not use this instrument in areas that present hazardous conditions such as excessive shock, vibration, dirt, moisture, corrosive gases or oil. Ambient temperature and humidity conditions should not exceed the maximum ratings as specified in this manual.

To clean this equipment, use a soft, dry cloth. Do not use harsh chemicals, volatile solvents such as thinner or strong detergents to clean the equipment in order to avoid deformation of the instrument case.

2.1 Unpacking

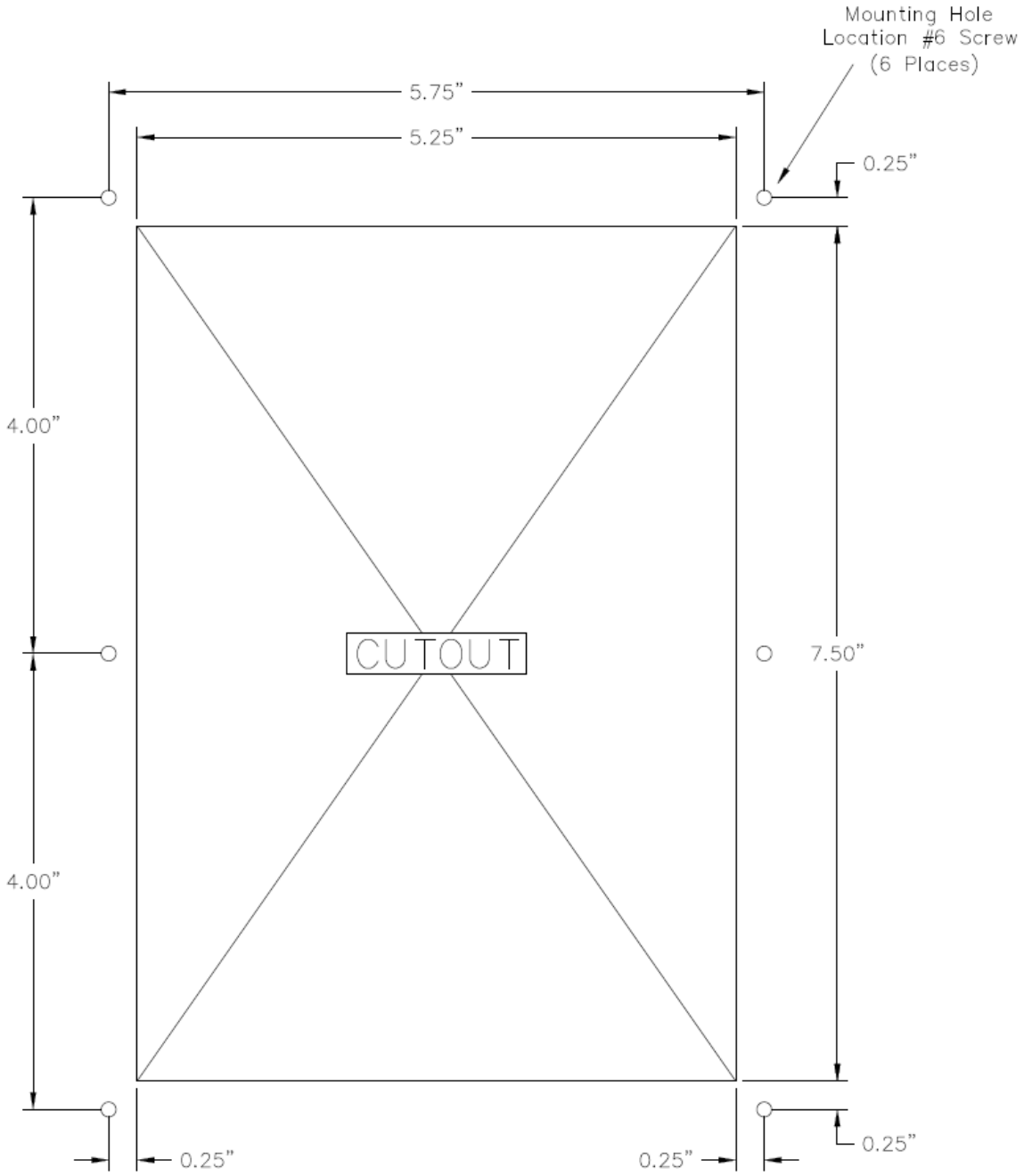
Upon receipt of shipment, remove the controller from the carton and inspect the unit for shipping damage. If there is any damage due to transit, report and file a claim with the carrier. Note the model number and serial number for future reference when corresponding with our service center.

The controller is designed for indoor use only and is not intended for use in hazardous areas. It should be located/installed in such a manner as to minimize effects of shock, vibration, and electromagnetic fields (such as variable frequency drives), motors and transformers. It is designed to operate under the following environmental conditions.

Environmental Parameter	Specification
Operating Temperature	-10°C to 50 °C
Humidity	0% to 90% RH (Non-condensing)
Altitude	2000 M Maximum

2.2 Mounting

Make the panel cut out as per the dimensions shown in the following figure:



2.3 Wiring

Electrical power in an industrial environment contains a certain amount of noise in the form of transient voltage and spikes. This electrical noise can enter and adversely affect the operation of microprocessor-based controls. For this reason, we strongly recommend the use of shielded thermocouple extension wire which connects the sensor to the controller. This wire is of twisted-pair construction with foil wrap and drain wire. The drain wire is to be attached to ground at one end only.

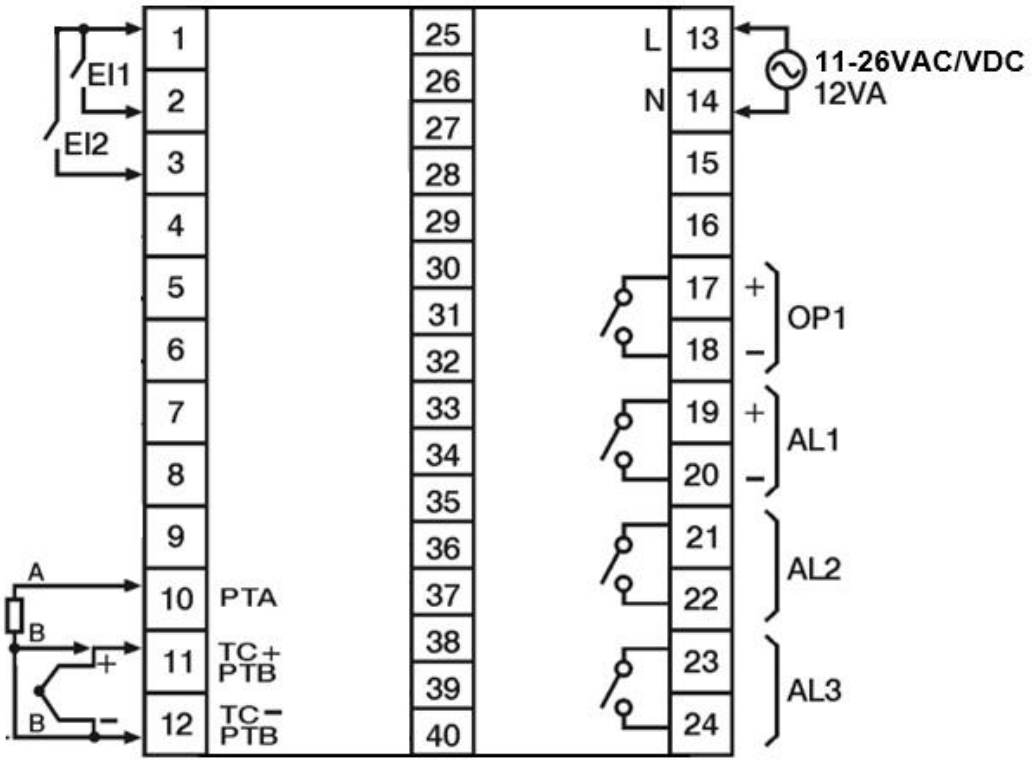
The utmost care must be taken to ensure that the maximum voltage rating specified on the controller label is not exceeded. It is recommended that the supply power of these units be protected by a fuse or circuit breaker rated at the lowest value possible.

All units should be installed inside a suitably grounded metal enclosure to prevent live parts being accessible to human hands and metal tools.

All wiring must conform to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for the voltage, current and temperature rating of the equipment.

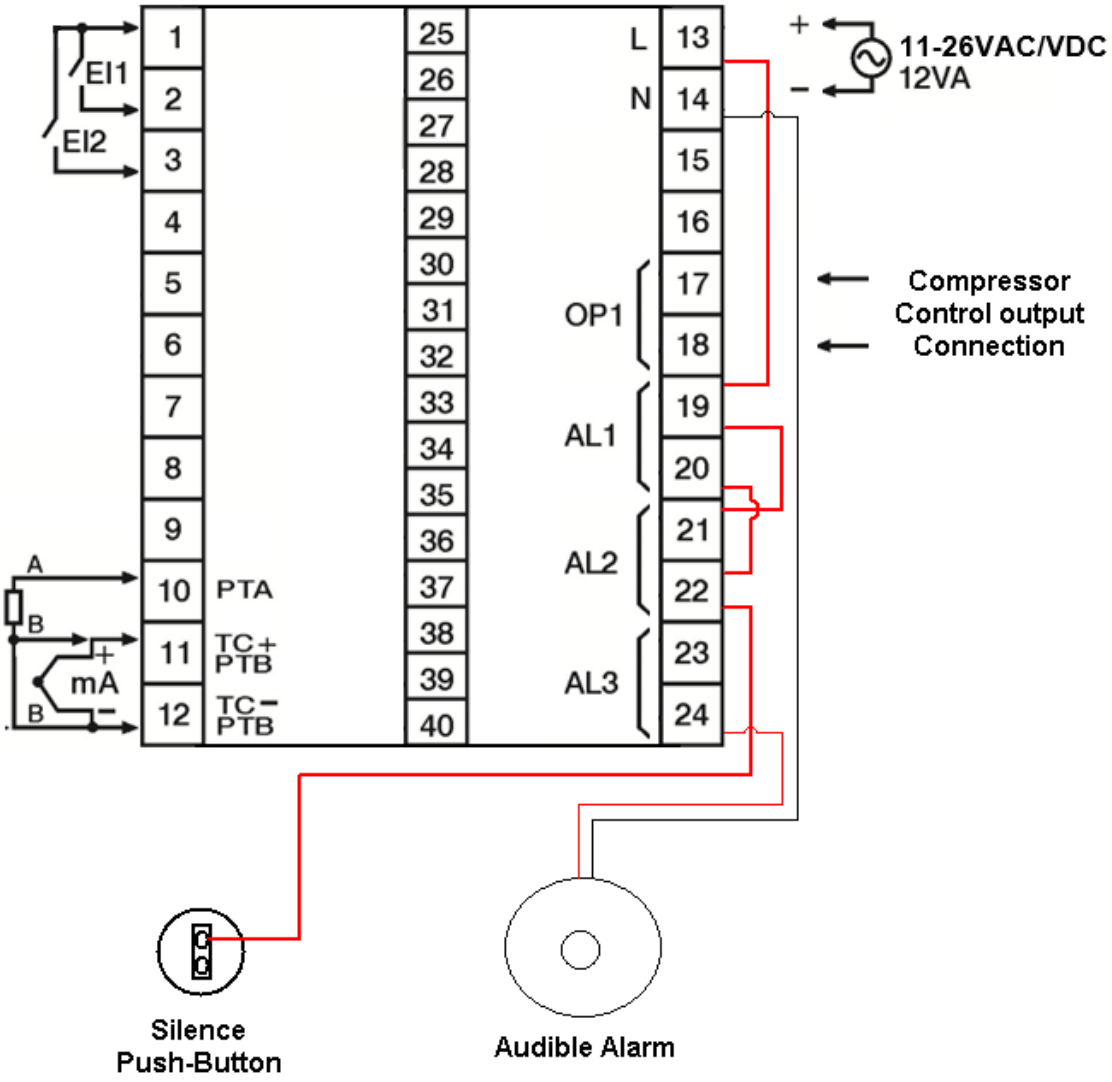
The tightening torque on the screw terminals should not exceed 1 N-m (8.9 Lb-in or 10.2 Kg F-cm). Except thermocouple wiring, all other wires used are to be standard copper conductors with the maximum gauge not exceeding 14AWG.

Rear Terminal Layout



The control assembly is provided with the alarm relay outputs, alarm silence push-button and audible alarm pre-wired to aid in assembly. The pre-installed jumpers combine alarm outputs one and two (for temperature and power failure) together so that only a single connection is required in order to activate the external alarm relays.

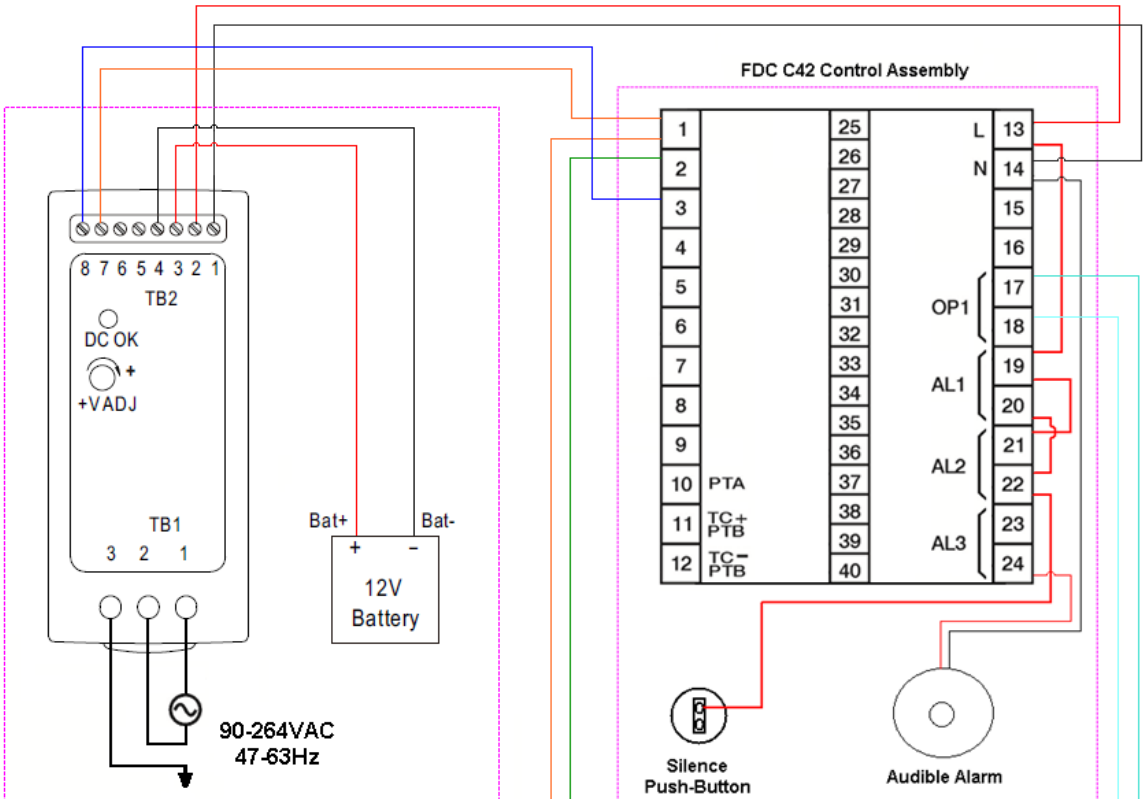
One terminal of the push-button is pre-wired to the alarm outputs, so that only a single connection must be made to the alarm silence relay. The audible alarm is pre-wired to the negative of the power supply terminals as well as one terminal of the alarm 3 output (not used). This provides an easy termination point for the field wiring required to active the audible alarm.



2.3.1 Main Power (Battery Backup) and Control Connections

The FDC C42 control unit was designed to use 12VDC power for its main power supply. The following connection diagram is an example for the MEAN WELL DRC-40A power supply with built in battery charger (UPS function).

Power Supply			C42 Control Assembly	
Terminal	Description		Terminal	Description
1	Output (V-)	-	14	N (DC-)
2	Output (V+)	-	13	L (DC+)
7	Bat Low (-)	-	1	EI COM
8	Bat Low (+)	-	3	EI2



Terminal Pin No. Assignment (TB1):

Pin No.	Assignment
1	AC/L
2	AC/N
3	FG ⏚

Terminal Pin No. Assignment (TB2):

Pin No.	Assignment	Pin No.	Assignment
1	-V	4	Bat. -
2	+V	5,6	AC OK
3	Bat. +	7,8	Bat. Low

The control relay is a single pole / single throw (SPST) configuration. The control relay will energize and the contacts will close when the process value is at or above the set point value. The control relay will de-energize when the process value is at or below the set-point value minus the control hysteresis. This output is used to signal the control board to turn the compressors on and off. Event input 1 of the C42 control is utilized for the power failure alarm indication and is active by the power failure output of the control board.

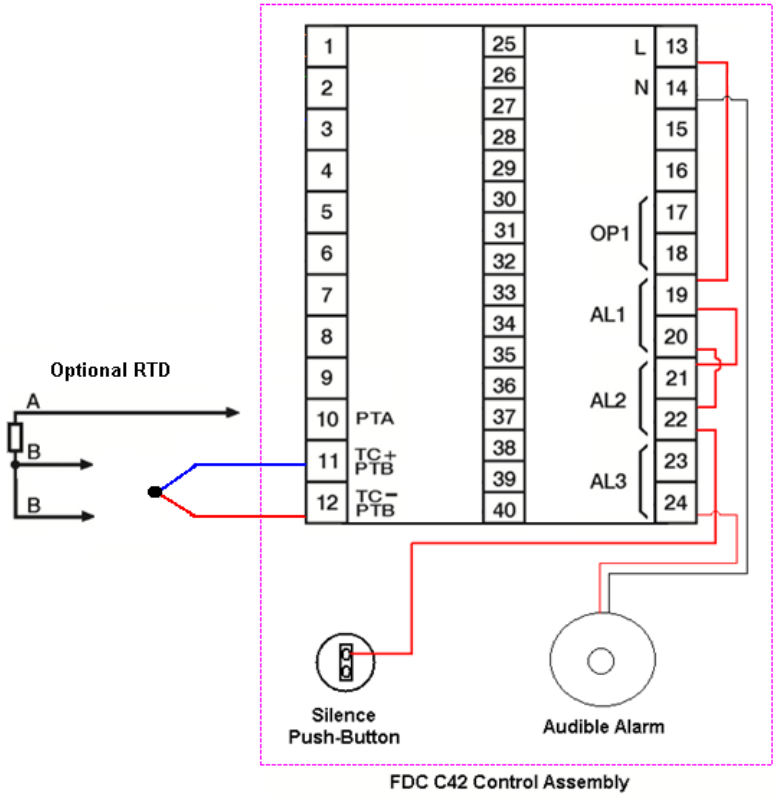
Control Board			C42 Control Assembly	
Terminal	Description		Terminal	Description
	Call For Cooling	-	17	OP1 (COM)
	Call For Cooling	-	18	OP1 (NO)
	Power Failure Relay	-	1	EI COM
	Power Failure Relay	-	2	EI1

2.3.2 Sensor Installation Guidelines

Proper sensor installation can eliminate many problems in a control system. The sensor should be placed so that it can detect any temperature change with minimal thermal lag. Some experimentation with sensor location is often required to find the optimum position.

Proper sensor type is also very important to obtain precise measurements. The sensor must have the correct temperature range to meet the process requirements. In special process, the sensor may need to meet different requirements such as leak-proof, anti-vibration, antiseptic, etc.

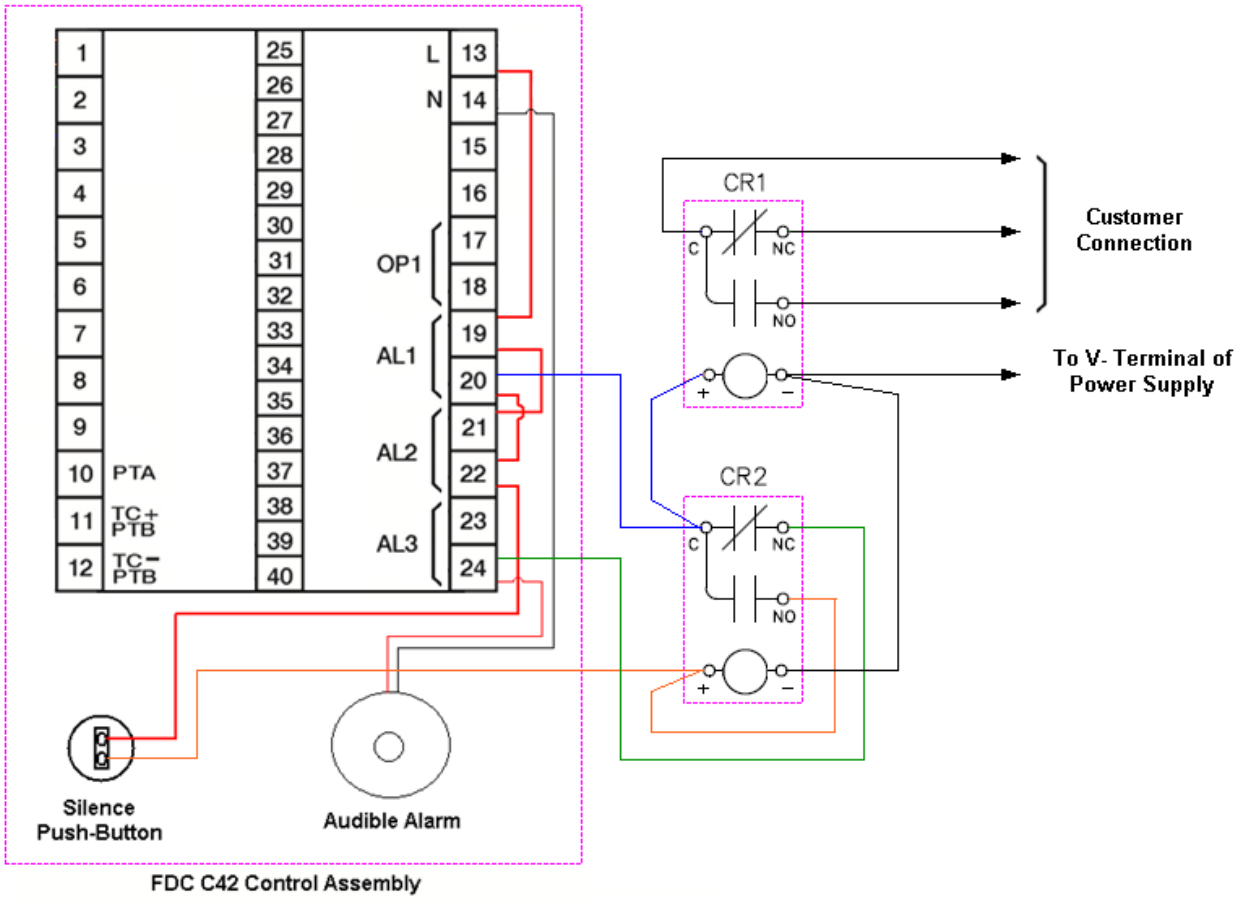
The FDC c42 control has been pre-configured for use with a “T” type thermocouple. The control is capable of utilizing other thermocouple types and even RTD temperature sensors if required by simply reconfiguring the input type selection. In the event of a sensor break, the upper LCD display will flash “SBER” and the control relay output will de-energize.



FDC C42 Control Assembly

2.3.3 Alarm Relay Output /Audible Alarm

Connection to the alarm relays and audible alarm require external control relays that are not part of the control assembly. One relay is utilized to provide remote contacts for customer connection for remote alarm indication (shown as CR1 in the following diagram) and is optional. The other relay is utilized for the audible alarm silence (shown as CR2 in the following diagram) which is required.



Note that alarm 3 (low battery) is utilized for indication only. When an alarm relay is energized, the corresponding alarm indicator, AL1 for alarm 1 (temperature), AL2 for alarm 2 (power failure) or AL3 for alarm 3 (low battery), will be illuminated on the upper left of the C42 LCD display. When either a high/low temperature or power failure alarm activates, the audible alarm will sound as power from the alarm contact will pass through the normally closed contact of relay CR2. When the silence button is pressed, the coil of relay CR2 will be energized. Since the normally open contact of CR2 will then close, power will pass through the relay contact and will in turn hold the relay coil energized even after the push-button is released.

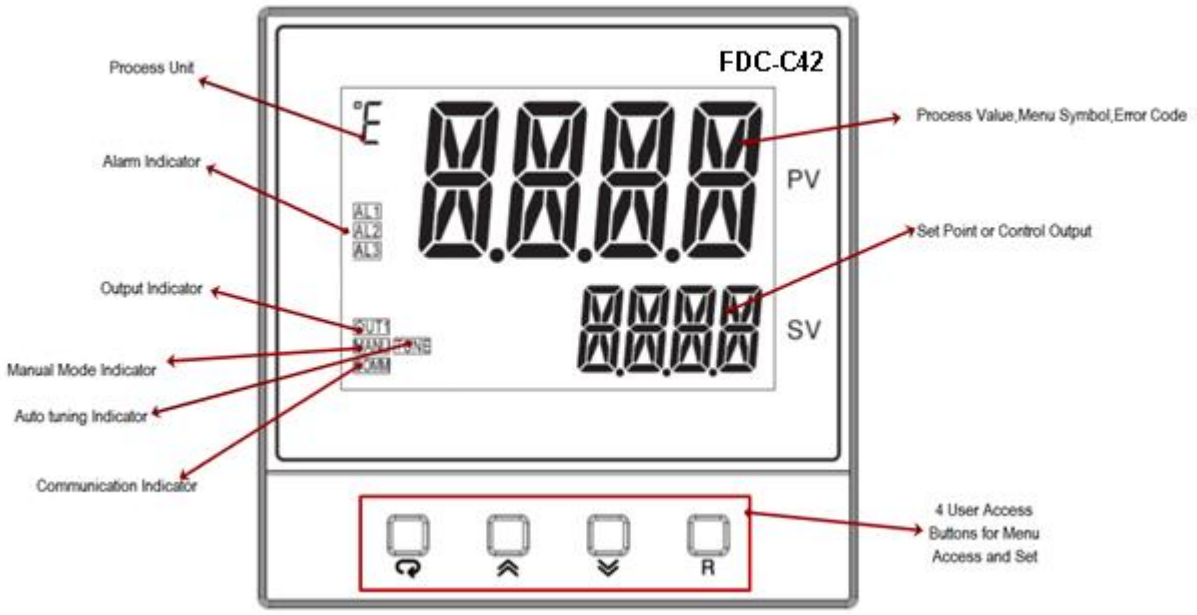
This will hold the normally closed contact of the relay open, removing power from the audible alarm so that it will no longer sound. Once both alarm conditions are no longer present, both alarm 1 and alarm 2 outputs of the C42 will be de-energized. This will in turn remove power from the coil of relay CR2 causing it to de-energize. This will then ensure that upon the next activation of either the temperature or power failure alarm output, power will again pass to the audible alarm causing it to sound until the alarm condition clears or the operator presses the silence button.

3 Operation

The FDC-C42 controller is programmed by using four keys on the front panel. The available function keys are listed in the following table:

Touch Key	Function	Description
▲	Up Key	Press and release to increase the current control set point (while in normal control mode) or to change the value of the selected parameter (while in the Setup Menu).
▼	Down Key	Press and release to decrease the current control set point (while in normal control mode) or to change the value of the selected parameter (while in the Setup Menu).
↺	Scroll Key	Press and hold for at least 5 seconds to enter the Setup Menu. The upper display will show SEt and then release the key.
R	Reset Key	Press and release to return the display to the home screen (while in User Menu or Setup Menu).

The upper display is used to show the process value or menu prompt. The lower display is used to show the set point value or menu parameter value. During power-up, the upper display will show PROG and the lower display will show the firmware version for 6 seconds.



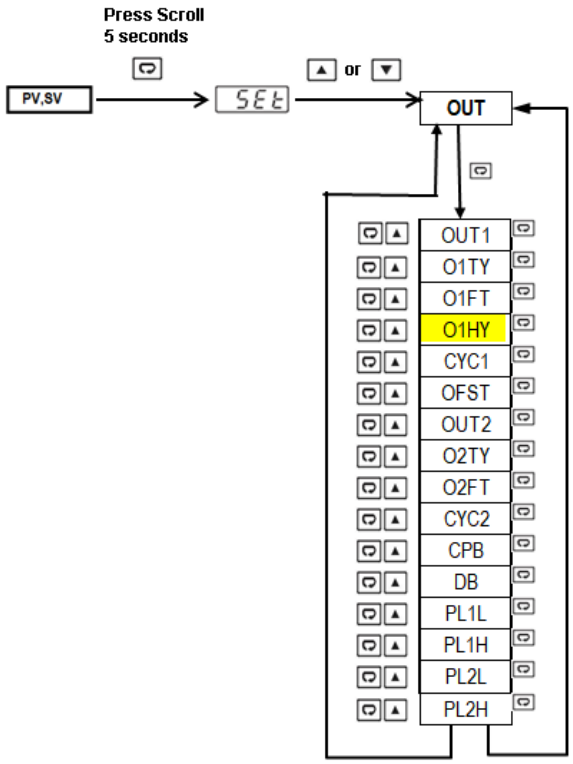
Note: *See the FDC C-Series User Manual (FDC_C-Series_User_Manual.pdf) for additional information on contoller specifications, error codes/troubleshooting and warranty/return information not covered in this manual.*

3.1 Control Output Hysteresis

The control type for relay output 1 is pre-configured for cooling (direct action). The control hysteresis (prompt O1HY) is safe-sided. The control relay's output will operate in the following manner. For example, the set point is -80° (F or C), and the control hysteresis value is 2.0. The control relay's output will be energized until the temperature reached -82° and then de-energize. When the temperature rises to -80° or above, the control relay's output is energized. When the control relay's output is energized, the control output status indicator (labeled OUT1 on the front panel) will be illuminated.

To change the control hysteresis, enter the Setup menu and access the output parameters as follows:

- Press and Hold scroll key for 5 seconds to enter Setup menu (upper display will show SET).
- Press up or down key repeatedly to access output parameters (lower display will show OUT).
- Press scroll key to cycle through output parameters and access output 1 hysteresis (upper display will show O1HY and lower display will show current value).
- Press up or down key to change hysteresis value.
- Press reset key to exit menu and return to normal PV/SV display.



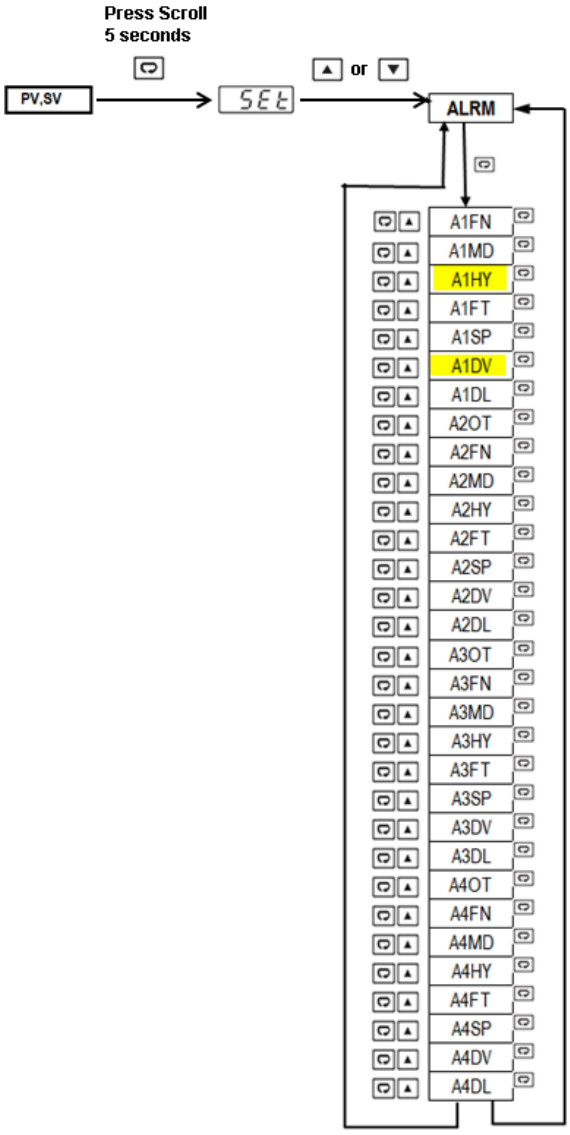
3.2 Temperature Alarm Set Point and Hysteresis

The alarm type for relay output 2 (AL1) is pre-configured for deviation band. This means that the alarm deviation set point (A1DV) follows the control set point evenly above and below the main control set point. The alarm hysteresis (A1HY) is safe sided.

The alarm relay's output will operate in the following manner. For example, the main control set point is -80° (F or C), the alarm deviation set point (A1DV) is 12° and the alarm hysteresis value (A1HY) is 0.1. The alarm relay's output will be energized when the temperature is outside of the deviation alarm band (below -92° or above -68°). The alarm relay will de-energize when the temperature falls within the hysteresis band (between -91.9° and -68.1°). When the alarm relay's output is energized, the alarm output status indicator (labeled AL1 on the front panel) will be illuminated.

To change the alarm set point and hysteresis values, enter the Setup menu and access the alarm parameters as follows:

- Press and Hold scroll key for 5 seconds to enter Setup menu (upper display will show SET).
- Press up or down key repeatedly to access alarm parameters (lower display will show ALRM).
- Press scroll key to cycle through alarm parameters and access alarm 1 hysteresis (upper display will show A1HY and lower display will show current value).
- Press up or down key to change hysteresis value.
- Press scroll key to cycle through alarm parameters and access alarm 1 deviation set point (upper display will show A1DV and lower display will show current value).
- Press up or down key to change alarm deviation value.
- Press reset key to exit menu and return to normal PV/SV display.



3.3 Power Status Alarm Indicators

The FDC-C42 events inputs 1 and 2 and alarm outputs 2 and 3 are pre-configured to act as power supply status alarms. Event input 1 and alarm output 2 (AL2) are utilized to indicate a power failure. Under normal operation, event input 1 will be activated indicating power is present. When main power is lost, event input 1 will deactivate, and in turn cause alarm 2 relay output to energize. When the alarm relay's output is energized, the alarm output status indicator (labeled AL2 on the front panel) will be illuminated.

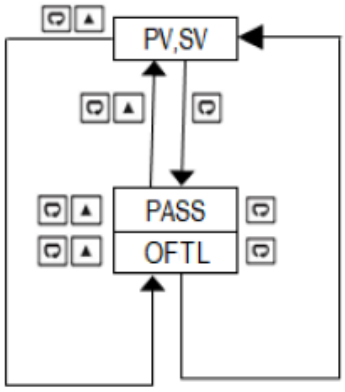
Event input 2 and alarm output 2 (AL3) are utilized to indicate low battery. Under normal operation, event input 2 will be deactivated. When the battery is low, event input 2 will be activated and in turn cause alarm 3 relay output to energize. When the alarm relay's output is energized, the alarm output status indicator (labeled AL3 on the front panel) will be illuminated.

3.4 Input Offset Calibration

Each unit is calibrated at the factory before shipment. The user can still modify the calibration in the field. The basic calibration of the controller is highly stable and set for life. User calibration allows the user to offset the permanent factory calibration in order to:

- Calibrate the controller to meet a user reference standard.
- Match the calibration of the controller to that of a particular transducer or sensor input.
- Calibrate the controller to suit the characteristics of a particular installation.
- Remove long term drift in the factory set calibration.

To correct for an error in the process value, send the desired low signal to the sensor input of the controller. If the process value (the upper display) is different from the input signal, access the offset low (OFTL) parameter by pressing and releasing the key twice.



The upper display will indicate the OFTL parameter and the lower display will show the current offset value. Use and keys to change the OFTL value and adjust it by the same error seen between the input signal and the indicated process value.

Press and release the key to return to the PV, SV display and verify that the indicated process value now matches the input signal. If an error is still present, repeat the procedure to adjust the OFTL value more to correct for the error