OPERATING MANUAL and INSTALLATION INSTRUCTIONS for **I-CON 2500 b339**

I-CON™ 2500

COMMERCIAL REFRIGERATION SYSTEM ENERGY ECONOMIZER

Description

The Intelligent Control Systems' *I-CON 2500* is a microprocessor-based energy-saving control for commercial refrigeration systems. The control reduces electric consumption and lowers compressor run-time by actively managing the compressor cycling pattern, in conjunction with the existing compressor controls. Note: The controller cannot cause the compressor to run when the controls are not calling for cooling. The controller also enhances compressor protection by eliminating short-cycling. In addition, certain parameters are programmable and are stored in memory that will not be lost in the event of the unit being turned off or a power failure.

Electric Ratings

Power input: 24,115,220 VAC ± 10%, 5 Watts max., 50/60Hz
Control circuit input: 24,115,220 VAC ± 10%, 0.1A max. Burden
Relay Contact: Form B, 10A @ 220 VAC (General Purpose)

Environmental Conditions

For Indoor Use.
Maximum Altitude: 9750 Ft. (3000M)
Rated Ambient Temperature: -20˚ -- 120˚F. (-29˚ -- 49˚C.)
Maximum Rh: 80% non-condensing
Mains Supply Voltage Fluctuations: ± 10%
Transient Over-Voltage Category: (III)
Pollution Degree: (2)

Note: The *I-CON* control must be operated within the specifications and protected from the elements. Failure to do so voids the warranty and guarantee. Below 32˚F (0˚C), the control will continue to operate but the LCD display may not function properly. The display will return to normal above that temperature.

Operation

After installation, setting the switch on the unit to the 'Normal' position activates the control. The LCD display indicates the various 'modes' of operation of the control, which is alternated with the accumulated Economizer Time, Compressor Run-time, Standby Time, and the Average Savings. The possible messages and their explanation are:

STANDBY MODE

The refrigeration systems temperature control has shut off the compressor after cooling the space to the desired temperature and that the control is waiting for the next call for the compressor to start. This occurs for a period of time after the compressor has shut down.

Note: A period (.) may be appended to the message and indicates that the Maximum Standby timer has expired (Default = 20 minutes) and that the compressor will start as soon as there is a call from the thermostat. If the compressor is running and the unit is still in the Standby Mode, call for service.

STANDBY / ASC The call from the refrigeration systems temperature control has been satisfied and the anti-short-cycle timer (Default = 30 seconds) is active. After the timer expires the message will change to "Standby Mode".

ECONOMIZER MODE

The refrigeration system's temperature control has requested the compressor to start but the control has intervened to delay the start based on information it has gathered from the previous cycle.

ECONOMIZE / ASC The call from the refrigeration systems temperature control has been sensed prior to the anti-short-cycle timer (Default = 30 seconds) expiring. After the timer expires the message will change to "Economizer Mode".

COMPRESSOR ON The control is passing the call signal through to the compressor.

COMP/ MAX ECON The call signal has been passed through to the compressor prior to the calculated hold-off time, due to the expiration of the Maximum Economizer Hold-Off Timer (Default = 20 minutes).

ET HRS: XXXXXX.X The accumulated Economizer Time.

RT HRS: XXXXXX.X The accumulated Compressor Run-Time.

ST HRS: XXXXXX.X The accumulated Standby Time.

A SAVE = XX.X % The calculated average savings of all compressor cycles since commissioning of the controller. The option to display this screen is programmable (Default = ON).
Note: *This message will not be displayed until there is sufficient data to perform the calculations.*

Installation

The *I-CON 2500* control is electrically installed in series with the refrigeration system's temperature controls as shown in the wiring diagrams. Check and determine the voltages of the compressor control circuit and power circuit prior to installation.
FOR SAFETY, POWER TO THE UNIT MUST BE DISCONNECTED DURING INSTALLATION.

Positioning

The unit must be protected from the elements and may be mounted on the equipment either vertically or horizontally. The unit should be mounted directly on the existing electric enclosure via the unit's standard ½" electrical fitting or within the enclosure using a mounting bracket. For mounting in the elements, a rain-tight mounting enclosure is available which should also be used if the control is mounted on the evaporator section in a refrigerated/freezer box.

Wiring

All wiring and connections must comply with Local and National Electrical Codes. The unit should be wired as shown in the wiring diagrams. It is important to read all of the instructions and the NOTE on the last page of these instructions. Ensure that POWER TO THE UNIT IS OFF DURING INSTALLATION and that all unused leads are individually insulated.

Checkout

Recheck wiring one last time. Set the *I-CON* switch to 'Reset/Bypass' and restore power to the refrigeration system. Note the system's temperature control setpoint and raise that setting to insure that there is no call for refrigeration, and that the compressor stops or is not running. Next, set the slide switch to 'Normal'. After the copyright / firmware revision info, the control will go into 'STANDBY / ASC' mode. Next, lower the setting to force a refrigeration call. The controller should change to either "Economize / ASC" or "Economizer Mode". If necessary, wait for the display to change to "Economizer Mode" (default = maximum 30 seconds). After a short delay the control should indicate "COMPRESSOR ON" and the compressor should start. Next, raise the setpoint again to remove the call for refrigeration and verify that the compressor stops and that the *I-CON* control returns to the

'STANDBY / ASC' mode. If the results of the above sequences are correct, the installation is wired properly and complete. Remember to reset the temperature control to the original setting noted above.

If the control does not come out of 'STANDBY MODE' when the thermostat is calling for the compressor to run, the unit is probably miswired; see Note 7 below, and the NOTE on the last page of these instructions. Check that the *I-CON*'s Yellow wire is connected to the "Y" lead coming from the Thermostat and that all of the 'common' connections are correct.

Service and Troubleshooting

After Installation and Checkout, the *I-CON 2500* does not require any maintenance and will provide years of trouble-free operation.

If the "FAULT DETECTED CALL 4 SERVICE" message is displayed, the control has detected an internal fault and has taken itself out of the circuit (bypassed itself). Service is required.

The unit may be bypassed at any time by putting the slide switch to the 'Reset/Bypass' position. In this position, the unit has no effect on the system and the compressor will function as it did prior to the *I-CON* installation. This allows service personnel to diagnose any problems without the *I-CON* interfering or being disconnected.

IMPORTANT - READ CAREFULLY

1. **Failure to follow these instructions may result in damage to the system or cause a hazardous condition.**
2. **Installer must be experienced, qualified, and in certain locations, licensed to work on the system that this control is being installed on.**
3. **After installation is complete, follow the check-out procedure as provided in these instructions to confirm proper system operation.**
4. **Intelligent Control Systems, LLC is not responsible for damages caused by improper installation or suitability.**
5. **Actual wiring may differ from that shown in the diagrams.**
6. **Equipment may have controls not shown.**
7. **The *I-CON* control can operate with different voltages for the power and control circuits. Because of this, it has separate common wires for those circuits. It is necessary that these wires be connected to the proper commons or the unit will not function properly. *See the wiring diagrams on the last page for details.***

IMPROPER VOLTAGE SELECTION MAY DAMAGE THE UNIT AND VOID THE WARRANTY.

CONFIGURATION

The following parameters may be changed in the field by following these instructions.
Maximum Standby-Timer Override, Anti-Short-Cycle Time, Maximum Economizer Hold-Off Time Override, Forced Cycle Management, and Cycle Management Percentage. The system may also be returned to factory default values and the 'Stand-by, Economizer, and Run' time accumulators may be reset.

All of the default values have been carefully selected to result in the greatest savings for the broadest scope of cooling system applications. Individual system requirements may require changes. Please note that all of these programmable parameters will affect the amount of savings. Prudent changes are strongly advised.

ALL PROGRAMMING IS ACHIEVED BY INSERTING AND REMOVING THE CONFIGURATION-KEY into the "REMOTE DATA OUT" port located on the side of the control.

YOU HAVE FIVE (5) SECONDS TO RESPOND TO ANY OF THE DISPLAY PROMPTS. THE 5 SECOND COUNTDOWN IS DISPLAYED ON THE CONTROLLER'S LCD DISPLAY.

CONFIGURATION MAY BE STOPPED OR ABORTED AT ANY TIME BY TOGGLING THE SWITCH TO 'RESET/BYPASS' AND BACK TO 'NORMAL'. ANY PARAMETERS THAT WERE CHANGED WILL REMAIN CHANGED.

Entering Configuration Mode:

To enter configuration mode, the controller must be reset (by toggling the switch to the 'Reset/Bypass' position and back to the 'Normal' position) with the Configuration-Key plugged into the "REMOTE DATA OUT" port located on the side of the control. To confirm, remove the Key when prompted. The unit will then indicated that it has entered "**Config Mode**". After a 4 second delay the display will advance to the first programmable parameter (RESET DEFAULTS?).

Any changes made to a programmable parameter will be confirmed by indicating "DATA SAVED**".**

RESET DEFAULTS?

This parameter will reset all of the programmable parameters to factory defaults. It will not clear any of the accumulators.

RESET TIMERS?

This parameter will clear (zero) the 'Standby, Economizer, and Run' time accumulators.

For all of the parameters that follow, after making a change and the "DATA SAVED**" message is displayed, you will be given an additional chance to change that parameter again, before advancing to the next programmable parameter.**

SAV DISPLAY OFF? OR SAV DISPLAY ON?

This parameter controls whether or not the Average Savings is displayed. The controller will prompt you to change to whatever value is NOT currently selected (default value = ON). For example, if the parameter is currently set to "ON", the only choice will be to change to "OFF".

ASC TIME= xx MIN

This feature of the controller is designed to minimize short-cycling of the compressor by setting a minimum amount of time that must lapse prior to allowing the compressor to run again. This timer starts when the cooling call from the thermostat is satisfied. For systems that provide other means of anti-short-cycle control, this feature may be disabled. To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (default = 30 seconds). Next the controller will count up until the maximum allowable value is reached (5 minutes), then "DISABLED", and then will jump to the minimum allowable value (1 minute). Remove the Key when the desired value is reached.

MAX ECON = x MIN

This feature of the controller is to limit the maximum amount of time that the controller is allowed to remain in the Economizer Mode. To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (default = 20 minutes). Next the controller will count up until the maximum allowable value is reached (60 minutes), then "DISABLED", and then will jump to the minimum allowable value (2 minutes). Remove the Key when the desired value is reached. If the controller goes in to the heating mode as a result of this feature, the message "COMP/ MAX ECON" will be displayed.

MAX STBY = xx MIN

This feature of the controller is to limit the maximum amount of time that the controller is allowed to remain in the Standby Mode as a means of monitoring the internal electronics against failure. If a cooling call is not sensed within the prescribed time period, the timer will expire and the control will take itself out of the circuit (fail-safe). A period (".") will be appended to the "**STANDBY MODE.**" message to indicate that this timer has expired. It will only reset upon sensing a call from the thermostat. Cycling power to the control will NOT reset the timer.

To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (default = 60 minutes). The controller will count up until the maximum allowable value is reached (90 minutes), then "DISABLED", and then will jump to the minimum allowable value (5 minutes). Remove the Key when the desired value is reached. **Disabling this function is NOT recommended!**

This condition is not necessarily a fault. It will occur naturally if the cooling system has been "off" or there are long periods of time between thermostat cooling calls. The only time that this should be considered a problem is if the controller is in "STANDBY MODE." and the compressor is running. This would indicate a failure of the on-board electronics and that the *I-CON* has taken itself out of the circuit.

NEW FEATURES TO BE USED WITH CAUTION!

The following feature allows the I-CON 2400 controller to be usable on undersized cooling systems, or on applications that place a very high demand on the cooling system for prolonged periods of time that precludes the systems from cycling on and off based on demand.

This feature should be used with caution, since it may cause temperature excursions beyond acceptable limits. It will however force savings based upon the selected parameters.

This feature of the controller will force the compressor off/on (provided that there is a cooling call from the thermostat) on a fixed time interval basis, based upon the setting of the CYCLE/HR and CYCLE%/HR settings.

The available settings of the CYCLE/HR parameter are the numbers 1 through 4 and DISABLED (Default = 1). Selecting a number between 1 and 4 will cause the CAC to force the compressor off that number of times per hour (provided that the cooling call is continuous). The duration of time that the compressor is forced off is determined by the CYCLE%/HR parameter (Default = 15%).
Example 1: The CYCLE/HR parameter is set to 1 and the CYCLE%/HR parameter is set to 15, the compressor will be cycled off, every 51 minutes of continuous run-time, for 9 minutes.

Example 2: The CYCLE/HR parameter is set to 2 and the CYCLE%/HR parameter is set to 15, the compressor will be cycled off, every 25½ minutes of continuous run-time, for 4½ minutes.

Example 3: The CYCLE/HR parameter is set to 4 and the CYCLE%/HR parameter is set to 5, the compressor will be cycled off, every 14¼ minutes of continuous run-time, for ¾ of a minute.

NOTE: The duration of the OFF cycle will never be shorter than the Anti-Short-Cycle Time. It is also possible, based upon the MAX ECON setting, that the stop-time will be overridden. For example, Max Econ is set to 1 minute. Cycles per hour is set to 2, Cycle%/HR is set at 10. This would normally result in a 3 minute turn-off of the compressor every 27 minutes. But, because the MAX ECON is set to 1 minute, the compressor will only be stopped for 1 minute. So, be cognizant of your settings and the interplay between them.

Anytime that the Systems temperature callsignal is interrupted the timer is reset and requires the continuous operation of the compressor for the required time before it will force the compressor off again.

CYCLE/HR = x

This parameter causes the controller to force the compressor OFF after the desired continuous run-time for that cycle has been satisfied.
To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (Default = 1). Next the controller will count up until the maximum allowable value is reached (4), then "DISABLD", and then will jump to the minimum allowable value (1). Remove the Key when the desired value is reached.

CYCLE%/HR = xx

This parameter sets the amount of time that the controller forces the compressor OFF per hour. To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (default = 15). Next the controller will count up until the maximum allowable value is reached (60%), then "DISABLED", and then will jump to the minimum allowable value (5%). Remove the Key when the desired value is reached.
NOTE: This parameter will not be displayed if CYCLE/HR = DISABLD……

CC DELAY = x HRS OR CC DELAY = DISABLD

This parameter will cause the controller to disable the CYCLE/HR function for the set number of hours once, upon control startup. To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (Default = DISABLD). Next the controller will count up until the maximum allowable value is reached (5), then "DISABLD", and then will jump to the minimum allowable value (1). Remove the Key when the desired value is reached.
NOTE: This parameter will not be displayed if CYCLE/HR = DISABLD……

MIN % DELAY = xx %

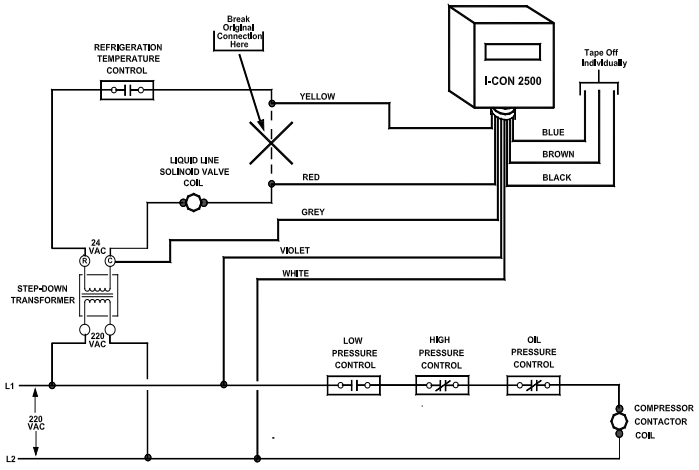
This feature of the controller sets the minimum amount of percentage time that the controller is allowed to delay the compressor from running. To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (default = 10 %). Next the controller will count up until the maximum allowable value is reached (Max % Delay), and then will jump to the minimum allowable value (10%). Remove the Key when the desired value is reached.

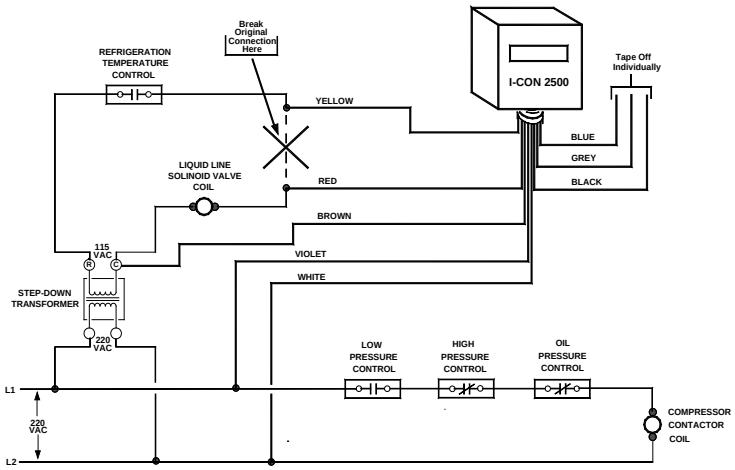
MAX % DELAY = xx %

This feature of the controller sets the maximum amount of percentage time that the controller is allowed to delay the compressor from running. To change this setting, plug in the Key when prompted. The indicated value will be what is currently set in the controller (default = 45 %). Next the controller will count up until the maximum allowable value is reached (60 %), and then will jump to the minimum allowable value (Min % Delay). Remove the Key when the desired value is reached.

AFTER THE LAST PARAMETER IS REACHED THERE WILL BE A BRIEF DELAY AND THE CONTROLLER WILL RESET. DURING THIS TIME THE KEY SHOULD BE DISCONNECTED OR THE CONTROLLER WILL ATTEMPT TO GO INTO THE CONFIGURATION MODE AGAIN. IF YOU DON'T REACT QUICKLY ENOUGH, RESET THE CONTROL BY TOGGLING THE SWITCH TO 'RESET/BYPASS' AND BACK TO 'NORMAL'.

Typical 1Ø or 3Ø Pump-down Type Refrigeration Systems





NOTE: Because the *I-Con 2500* can operate with different voltages for the power and control circuits, it has separate common wires for these circuits. It is necessary that these wires be connected to the proper 'commons' or the unit will not function properly. *See the wiring diagrams on this sheet for details.* These diagrams may not represent your particular installation.