

SECTION 27 - LARGE TONNAGE CHILLER (LTC) I/O BOARD 031-02895-000/001

Beginning August 2009, new chillers equipped for Hot gas bypass, Heat Recovery and/or Head Pressure Control options will be equipped with Input/Output Board 031-02895-000. It provides both Analog and Digital Input/Output capability to the microboard from external devices. *Figure 83 on Page 232* is a top level block diagram of this board. *Figure 84 on Page 232 through Figure 90 on Page 235* show details of the I/O circuits and should be referred to while reading the following description of the board operation. *Figure 91 on Page 236* is a board layout showing component identification.

The board is manufactured with either a -000 or -001 part number suffix. The -000 board is only populated with the components required for options requiring small additional I/O counts. The -001 board is for future use.

This board operates from +12VDC (TP3) and +24VDC (TP4) power supply voltages. The +12VDC applied to the +5VDC regulator produces a +5VDC regulated output (TP2), which causes the POWER LED (CR3) to illuminate. These voltages are referenced to GND (TP1).

Power fail circuits detect low DC voltage and put the processor into a reset state as long as the voltage is below a threshold. This prevents the processor from processing data while the DC Voltage is below the minimum required for stable circuit operation. The low voltage reset thresholds are:

- +5VDC supply @ 4.41VDC-4.87VDC
- +12VDC supply @ 9.6VDC-11.2VDC

When the I/O Board is operating, the STATUS LED (CR8) flashes at a regular interval (1/sec) indicating that the board is functional.

This board communicates with the microboard COM 3 serial port (J12) using Modbus Protocol RS-485 serial communications. When a read/write request is sent from the microboard, the microboard's TX3 (CR15) LED illuminates. When that request is received at the I/O Board, the I/O Board's RX (CR4) LED illuminates. When the I/O Board responds, the I/O Board's TX (CR5) LED illuminates. When the response is received at the microboard, the microboard's RX3 (CR16) illuminates.

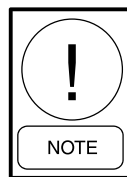
Each read/write request from the microboard contains a Modbus Net address. In order for the I/O Board to respond to the microboard's requests, the Modbus Net address of the I/O Board must match the one sent from the microboard. The Modbus Net address of the I/O Board is set with 4 position DIP switch SW1, labeled NET ADDRESS. This should be set to "1" by setting SW1-1 to ON and the other segments to OFF.

The operating program is stored in the processor. The program is downloaded into the processor through the J1 programming port at the time of board manufacture. Service replacement boards are provided preloaded with the proper software. It is not necessary to field load software into the board.

This board is only compatible with Microboard 031-02430-000/-001 equipped with software version C.OPT.01.21.307 (or later). It cannot be used with Microboard 031-01730-000 or any previous software versions.

Refer to the following sections of this manual for a description of how this board is interfaced for these applications:

- **Hot gas bypass** - SECTION 23 - HOT GAS BYPASS
- **Heat Recovery** - SECTION 28 - HEAT RECOVERY
- **Head Pressure Control** - SECTION 29 - HEAD PRESSURE CONTROL



Important! *These are not general purpose I/O points available for field use. Unless specifically listed in above referenced sections of this manual, the I/O point cannot be used.*

DIGITAL INPUTS

120VAC Digital inputs

These inputs accept a 120VAC input. *Figure 84 on Page 232* is a detail of this input and is representative of all of these inputs. Each input is applied to the respective (+) and (-) input. Each input is applied to an opto-coupler circuit that converts the AC voltage to a DC voltage. Each input has an LED associated with it. The respective LED illuminates when the 120VAC input is present. Otherwise, it is extinguished. The -000 board is component populated for 2 inputs. The -001 board is populated for 6 inputs.

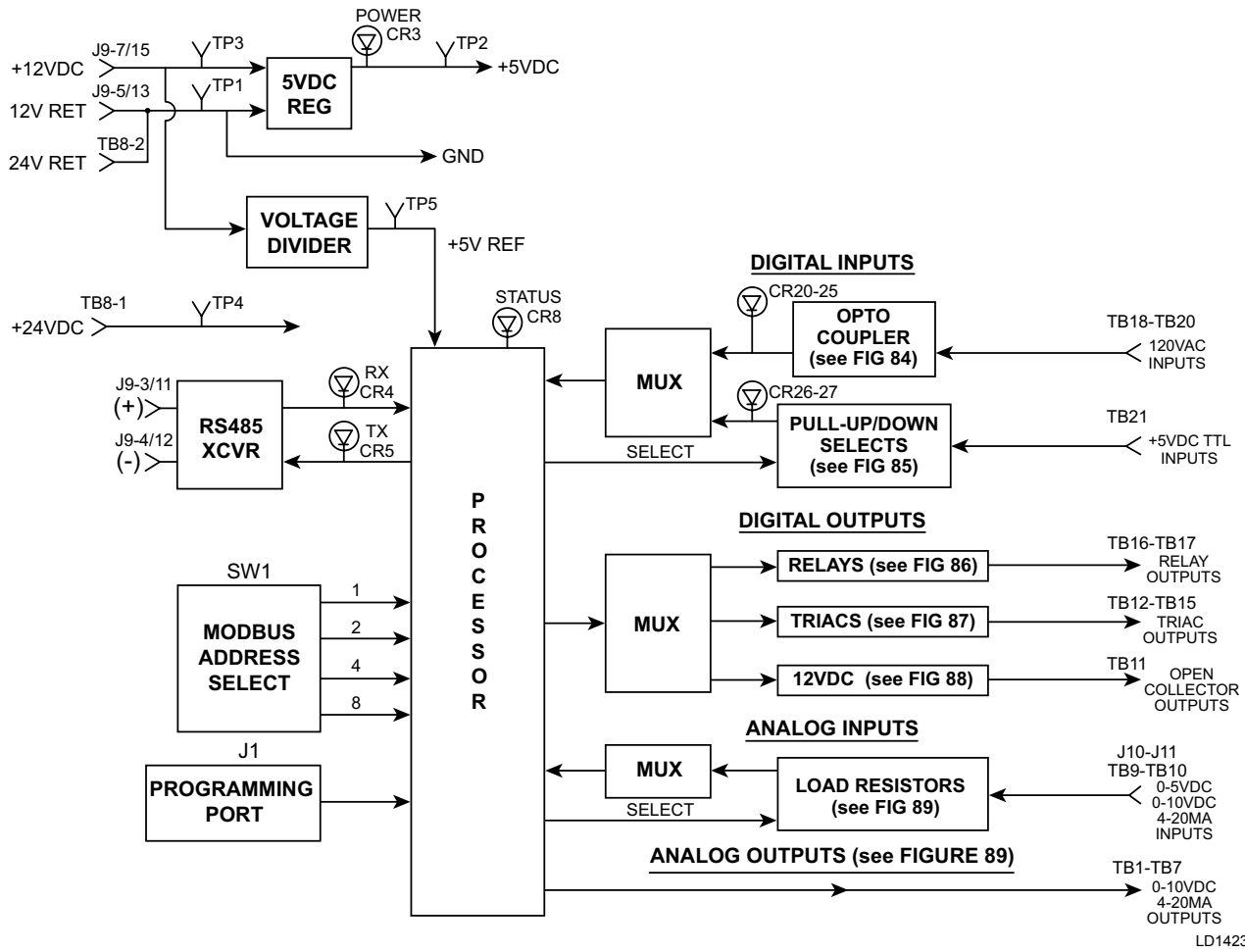


FIGURE 83 - LTC I/O BOARD BASIC BLOCK DIAGRAM

INPUT	CONNECTION	LED
DI1	TB20-1(+) -2(-)	CR20
DI2	TB20-3(+) -4(-)	CR21
DI3	TB19-1(+) -2(-) (-001 board only)	CR22
DI4	TB19-3(+) -4(-) (-001 board only)	CR23
DI5	TB18-1(+) -2(-) (-001 board only)	CR24
DI6	TB18-3(+) -4(-) (-001 board only)	CR25

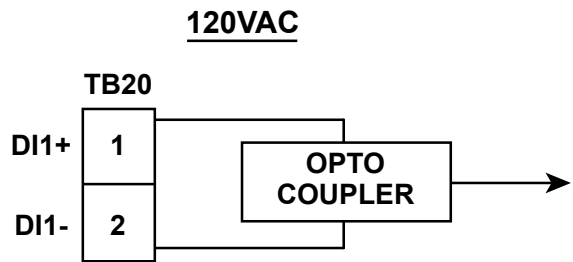


FIGURE 84 - 120VAC DIGITAL INPUT

+5VDC Digital inputs (-001 Board only)

There are 2 each +5VDC TTL inputs. *Figure 85 on Page 233* is a detail of an input and is representative of all of these inputs. Each input accepts an open/close input that can be configured in either pull-up configuration (+5VDC when open/0VDC when closed) or pull-down configuration (0VDC when open/+5VDC when closed). It is connected between the +5VDC and the DI input for a pull-up configuration; between the GND and DI input for a pull-down configuration. Under Program control, the pull-up/pull-down selector switch connects the input load resistor to either +5VDC (pull-up) or ground (pull-down) per the requirements of the input.

INPUT	CONNECTION	LED
D17	TB21-1 +5VDC -2 DI7 -3 GND	CR26
D18	TB21-4 +5VDC -5 DI8 -6 GND	CR27

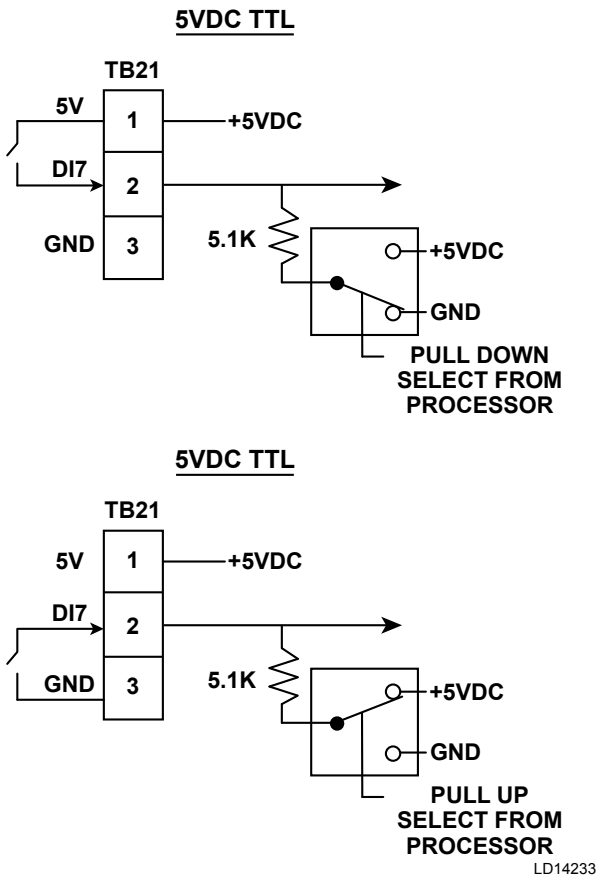


FIGURE 85 - +5VDC DIGITAL INPUT

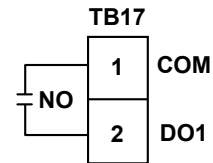
DIGITAL OUTPUTS

Relay Outputs (-001 Board only)

There are 2 each 120/240VAC relay contact outputs. *Figure 86 on Page 233* is a detail of an output and is representative of all these outputs. Each relay has one set of normally open contacts that are closed and opened under Program control. The relay contact rating is 250VAC, 5 amps resistive, 2 amps inductive. Each output is connected between the respective COM(X) and NO(X) terminals.

OUTPUT	CONNECTION
DO1	TB17-1 COM1 -2 NO1
DO2	TB16-1 COM2 -2 NO2

RELAY OUTPUTS



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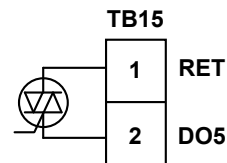
FIGURE 86 - RELAY OUTPUTS

Triac Outputs (-001 Board only)

There are 4 each 24/120VAC triac outputs. *Figure 87 on Page 233* is a detail of an output and is representative of all these outputs. Each output can switch 2 amps at 17-132VAC. Each output is connected between the respective RET and DO(X) connection.

OUTPUT	CONNECTION
DO5	TB15-1 Ret -2 DO5
DO6	TB14-1 Ret -2 DO6
DO7	TB13-1 Ret -2 DO7
DO8	TB12-1 Ret -2 DO8

TRIAC OUTPUTS



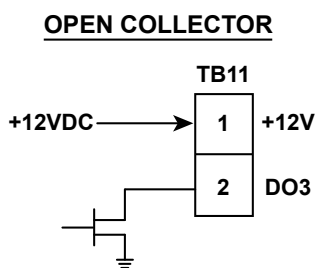
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FIGURE 87 - TRIAC OUTPUTS

Open Collector Outputs (-001 Board only)

There are 2 each open collector outputs. *Figure 88 on Page 234* is a detail of an output and is representative of all these outputs. Each output switches a ground connection through an onboard solid state device to an external load connected to the board supplied +12VDC power source. Each output is connected between the respective +12VDC and DO(X) terminals.

OUTPUT	CONNECTION
DO3	TB11-1 +12VDC -2 DO3
DO4	-3 +12VDC -4 DO4



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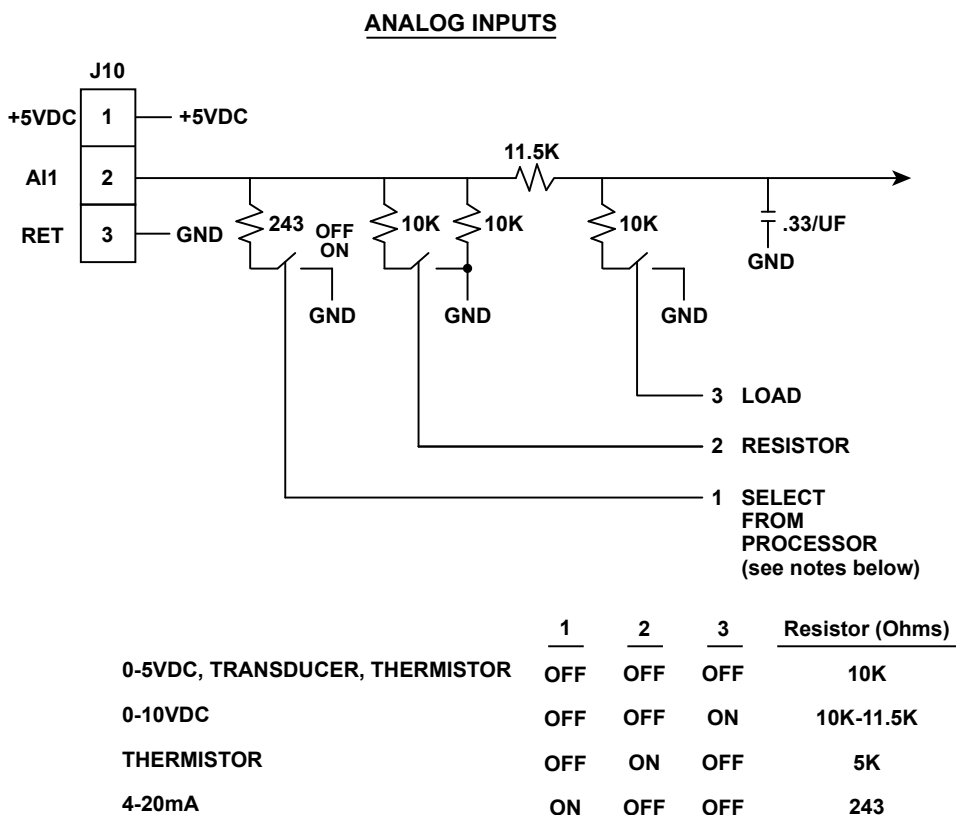
FIGURE 88 - OPEN COLLECTOR

ANALOG INPUTS

There are 8 each Analog Inputs on the -000 board and 16 each on the -001 board. *Figure 89 on Page 234* is a detail of this input and is representative of all these inputs. Each input accepts either a 0 to 5VDC, 0 to 10VDC, 4 to 20mA, Transducer or Thermistor input. The on-board software configures each input per the requirements of the input type. The configuration consists of selecting the appropriate input series resistor to ground. The software closes the appropriate switch(s) (1, 2, 3), selecting the appropriate input resistor. *Figure 89 on Page 234* shows the switch settings and resistance values for each input type.

Inputs AI7 and AI8 have dual input connectors that allow either a pin/socket connection or screw terminal connection as shown below.

Thermistors and transducers operate from the board supplied +5VDC supply voltage. To compensate for a varying +5VDC supply voltage, this voltage is compared to a precise +5VDC reference. The output of the device is adjusted according to any difference.



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FIGURE 89 - ANALOG INPUTS

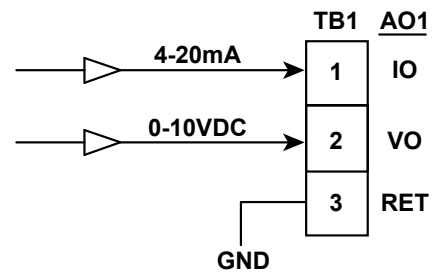
INPUT	CONNECTION
AI1	J10-1 +5VDC -2 AI1 -3 Ret
AI2	J10-4 +5VDC -5 AI2 -6 Ret
AI3	J10-7 +5VDC -8 AI3 -9 Ret
AI4	J10-10 +5VDC -11 AI4 -12 Ret
AI5	J10-13 +5VDC -14 AI5 -15 Ret
AI6	J10-16 +5VDC -17 AI6 -18 Ret
AI7	J10-19 +5VDC -20 AI7 or TB9-1 -21 Ret TB9-2
AI8	J10-22 +5VDC -23 AI8 or TB9-3 -24 Ret TB9-4
AI9	J11-1 +5VDC (-001 board only) -2 AI9 -3 Ret
AI10	J11-4 +5VDC (-001 board only) -5 AI10 -6 Ret
AI11	J11-7 +5VDC (-001 board only) -8 AI11 -9 Ret
AI12	J11-10 +5VDC (-001 board only) -11 AI12 -12 Ret
AI13	J11-13 +5VDC (-001 board only) -14 AI13 -15 Ret
AI14	J11-16 +5VDC (-001 board only) -17 AI14 -18 Ret
AI15	J11-19 +5VDC (-001 board only) -20 AI15 -21 Ret
AI16	J11-22 +5VDC (001 board only) -23 AI16 -24 Ret

ANALOG OUTPUTS

There are five analog outputs on the -000 board and seven on the -001 board. *Figure 90 on Page 235* is a detail of this input and is representative of all these inputs. Each output can provide a 0 to 10VDC output (between terminals 2 and 3) or 4 to 20mA output (between terminals 1 and 3).

OUTPUT	CONNECTION
AO1	TB1-1 4 to 20mA -2 0-10V -3 Ret
AO2	TB2-1 4 to 20mA -2 0-10V -3 Ret
AO3	TB3-1 4 to 20mA -2 0-10V -3 Ret
AO4	TB4-1 4 to 20mA -2 0-10V -3 Ret
AO5	TB5-1 4 to 20mA -2 0-10V -3 Ret
AO6	TB6-1 4 to 20mA (-001 board only) -2 0-10V -3 Ret
AO7	TB7-1 4 to 20mA (-001 board only) -2 0-10V -3 Ret

ANALOG OUTPUTS



LD14236

FIGURE 90 - ANALOG OUTPUTS

AUTO DETECTION

Earlier vintage chillers use Analog I/O Board 371-02514-000 for the ht gas bypass feature. This board also connects to the COM3 serial port (J12). Since this board uses different protocol than the 031-02895-xxx board, the microboard must know which board is present in order to be able to communicate with it.

The microboard determines which board is present by the features that are enabled:

- If heat recovery and/or or head pressure control is enabled, it knows the 031-02895-xxx board is present and only the 031-02895-xxx board is polled.
- If only hot gas bypass is enabled, the microboard automatically determines which board is present. At boot-up, the microboard alternates between polling the 031-02895-xxx board and the 371-02514-000 Board. Once a valid response is received from one of these two boards, the communications will continue to only poll that board type.

DIAGNOSTIC SCREEN

The DIAGNOSTIC Screen (Refer to *Figure 106 on Page 304*), accessible from the MAIN DIAGNOSTICS Screen, is used to analyze the analog and Digital inputs and outputs. It is also used to manually control the digital outputs and set analog output voltages.

There are two versions of this screen available as follows:

Service Access level

The voltage value of each analog input at the board input terminals/pins, as interpreted by the I/O Board and transmitted to the microboard, is displayed as ANALOG INPUTS.

The voltage value sent from the microboard to the I/O board for analog output displays as ANALOG OUTPUTS.

The ON/OFF status of the Digital inputs and Digital Outputs are indicated with an LED. It is illuminated when the input or output is on; extinguished when it is off.

Modbus communication error counters are displayed as follows, along with the ability to reset the counters:

- ID faults – This is the number of packets received with an incorrect slave ID.
- Checksum errors – This is the number of checksum errors encountered in communication.
- Error packets – This is the number of error packets received.
- Timeout Faults – Number of timeout faults encountered. A timeout is registered when no valid response is received for a poll within two seconds.

SERVICE access level plus Microboard DIP Switch 1-3 to ON (Refer to *Figure 17 on Page 66*)

In addition to the displays above, the following can be performed.

The digital outputs can be individually turned on or off. Use the SELECT DIGITAL OUTPUTS key to select the desired output, then use the ENABLE and DISABLE keys to turn it on or off.

The analog outputs can be individually set to a desired voltage value. Use the SELECT ANALOG OUTPUT key to select the desired output, then use the numeric keys to set it to the desired value.

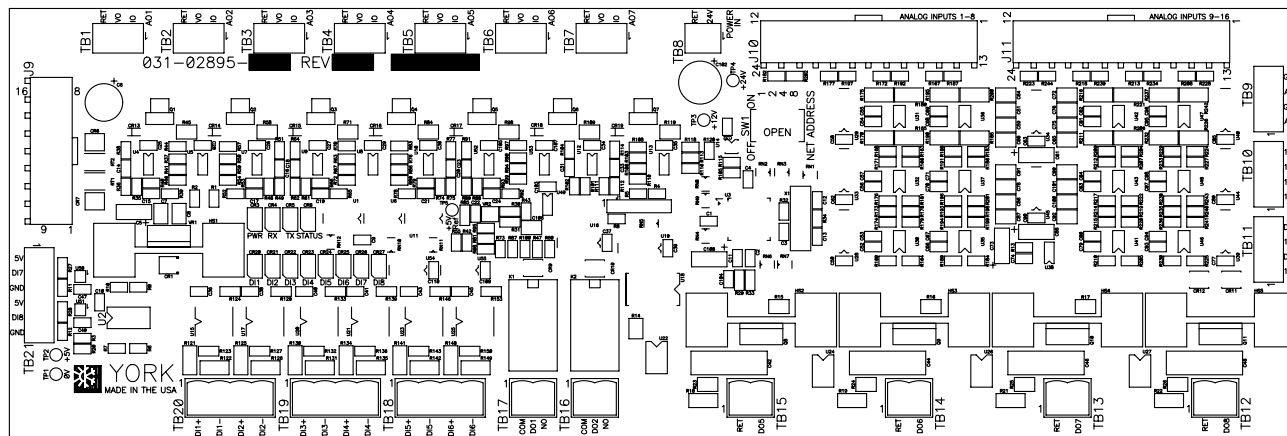


FIGURE 91 - I/O BOARD (031-02895-XXX)

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