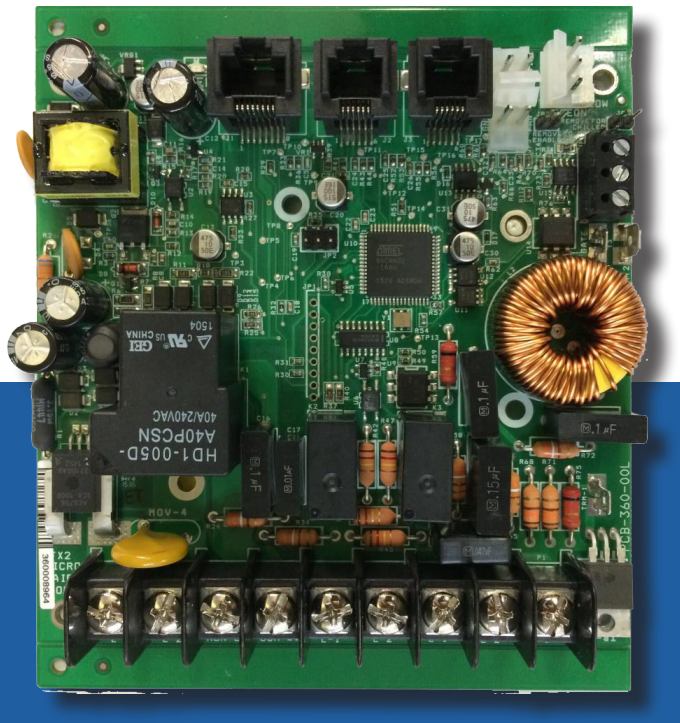
NORTHERN LIGHTS®

OPERATOR'S MANUAL



OTFX-2 BOARDS

for the FX-2 Control Board



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Read this operator's manual thoroughly before starting to operate your equipment. This manual contains information you will need to run and service your new unit.

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Introduction

The FX-2 control board platform is a versatile control interface that supports a variety of displays and system configurations. Among the supported configurations are direct expansion (DX), air handler (AH), fresh air makeup unit (FAMU), EasyStart, and chiller control. The table below lists the compatible displays and the available options for each.

DX and AH are hardware selectable options in compatible displays.

FAMU is a software compatible option in compatible displays. It can function in both DX and AH systems.

EasyStart is a factory installed option that must be ordered with the FX-2 power supply. It reduces compressor starting current by controlling start characteristics. EasyStart can be used in systems where current supply is marginal or to reduce flickering of lights during starts.

Chiller is a low cost chiller control that utilizes special software in a FX-2 Joystick display and a standard FX-2 control board. The chiller provides only basic water in based temperature control and standard fault detection along with freeze detection. Boards are operated as standalone systems and do not have run time equalization in multi-unit systems.

Modes/Options	**Compatible Displays**				
	FX-2	Easy Touch	FX-1	FX-MAXX	FX-2 Joystick
DX	X	X	X	X	
AH	X	X	X	X	
FAMU	X				
EasyStart	X	X	X	X	
Humidity Reduction Mode		X			
CAN	X				
Chiller					X
DC Fan option board	X				

Jumper Settings

Hardware jumpers are provided on the FX-2 control board to provide additional functions. Printed circuit board (PCB) revision I and earlier have jumpers that must be set for proper display operation. Revision K and above automatically detect the display and do not have display setting jumpers. All boards have the configuration jumpers shown in the configuration table below.

Display Selection (rev I and earlier PCB):

	JP9	JP11	Usage
OLED	OFF	OLED	OLED display
FX-MAXX	ON	FXMAX	FXMAX display

Configuration (all revisions):

System	JP7	JP8	Usage
AH	ON	OFF	ALL
DX	OFF	ON	With low Freon pressure switch
DX	ON	ON	No low Freon pressure switch
FAMU-AH	ON	OFF	Air Handler
FAMU-DX	ON	ON	No low Freon
FAMU-DX	OFF	ON	Low Freon
Chiller	ON	ON	Chiller 1 with No LP Switch
Chiller	ON	OFF	Chiller 1 ith No LP Switch
Chiller	OFF	ON	Chiller 2 with LP Switch
Chiller	OFF	OFF	Chiller 2 with LP Switch

Systems with EasyStart

Contactors

Systems with compressors over 24K BTU or greater than 1.5 HP must use a contactor. See the wiring diagram for details.

Capacitor Selection

Best start performance, in most cases, can be achieved by using the start capacitor values found in the table below.

BTU Rating	Start Capacitor Size
37K to 48K	189 to 227UF
25K to 36K	130 to 156UF
12K to 24K	88 to 106uF
5K to 11K	64 to 77uF

Run capacitors should be sized according to the compressor manufacturer's recommendations. Both capacitors often see voltages much higher than the applied line voltage. Select capacitors that have the appropriate voltage rating for your system.

Initial Starts

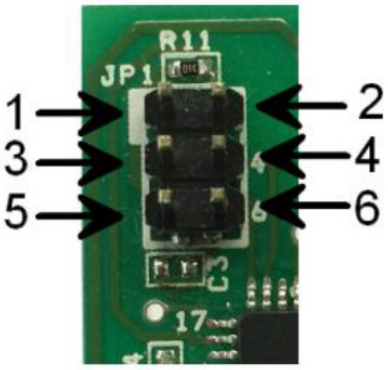
EasyStart has adaptive software that collects data during the first five starts of the compressor. EasyStart uses this data to determine the best starting characteristic for minimum start current delivered to the compressor. It is highly recommended that these starts be done with a stable power source such as shore power. Start the compressor five times after installation on shore power to allow EasyStart to learn about the compressor. No further setup is required.

Forcing EasyStart to relearn

EasyStart may be reset to perform the learning process. This is used when changing compressors or if instructed by to manufacturer to do so. Follow these steps below to complete this process. Refer to the FX-2 DX EasyStart wiring diagram for jumper position identification.

1. Remove AC power
2. Short pins four (4) and six (6) on JP1 with the black jumper.
3. Restore AC power for 30 seconds.
4. Remove AC Power.
5. Remove the jumper from pins four (4) and six (6) on JP1 and place it over pins three (3) and four (4).
6. Restore AC power and start the compressor five times. EasyStart will relearn the start characteristics of the compressor.

Additional EasyStart Jumper Usage



The pin header JP1 on the EasyStart top board is used to configure EasyStart. The white block shown by the arrow one indicates pin number 1. Other pins are identified as shown in relation to pin 1.

Caution: Do not place jumpers on JP1 except as indicated.

Normal: Most operation should be done without a jumper installed on JP1 or with the jumper installed across pins 3 and 4.

Re-learn: If a compressor, start capacitor, or run capacitor is replaced, place a jumper on pins 4 and 6. Cycle power on then off again. Remove the jumper and place it across pins 3 and 4. Cycle the compressor on then off five times to complete the setup. Be sure to allow enough time for pressure to bleed off between cycles in systems without a reversing valve.

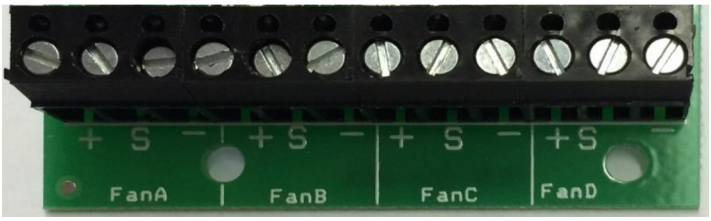
Default: A compressor may be operated with a factory defined start characteristic. This may not be the optimal start for the connected compressor and is generally used for factory diagnostics. Install a jumper across pins 1 and 3 for this configuration. No optimization is done with this setting.

Disable: This setting disables the microprocessor on the board so no operation can occur. Use this setting on an FX-2 system if you are installing a compressor with its own start device and are not using EasyStart. In this case you must follow the wiring diagram for a standard FX-2 system. Install a jumper across pins 5 and 6 for this configuration.

DC Fan Option Board

The PCB-361 option board is factory installed on the FX-2 control board. This option allows up to four PWM controlled DC fans to be connected. Speed control for each fan is individually adjustable in the programmable parameters on compatible displays.

Fan Connections



Each fan is connected by three wires to the control board. Connect the control wires to their corresponding terminals on the option board. The '+' terminal is connected to the DC fans' +10 volt output. The '-' terminal is connected to the DC fans' ground control wire only. Do not connect the GND wire to an AC ground. The 'S' terminal is connected to the DC fans' 0-10V signal wire.

Connect the DC fan's AC input directly to the AC line input. All other connections to the FX-2 control board are as they would be in a normal installation.

Notes:

- The FX-2 control board provides an output for a triac driven fan connected to Fan L1 and Fan L2 on the FX-2 control board. When connected, the fan will follow the speed control for Fan A on the DC fan option board.

- Do not connect the DC fan power source to the Fan L1 terminal on the FX-2 control board. Power for the DC fan must be supplied by the AC L1 and AC L2 terminals.

- The DC fan option board cannot be used with combination humidity and air sensors. Improper or erratic operation can result if combination humidity and air sensors are installed. EasyTouch humidity control feature is not available with the DC option board installed.

CAN Bus Systems

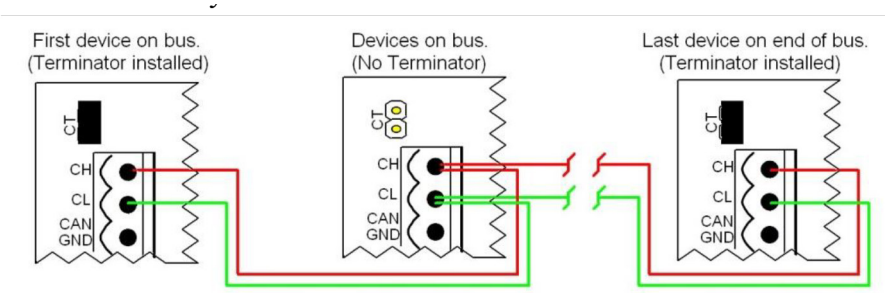
Basics

The CAN system (Computer Area Network) is a communications protocol system that facilitates communication between electronic controls. Controls are connected to each other to form a network. Typical controls in a network could include ice makers, chilled and heated water systems, air handlers, and direct expansion systems. The physical connection is called a bus and consists of a minimum of two wires connected to each device. Up to 127 controls including a computer connection may be connected on one bus. CAN bus exchange protocol follow the ISO-11898 standard for CAN specification 2.0 Part B. System integrators can find the message contents defined in the CAN protocol specification available from Northern Lights.

Wiring the CAN bus

The bus consists of a two or three wire connection to each device in the system. Wires are connected to each control in a sequentially wired, daisy chain style connection. Wire used for the CAN bus must be rated as indicated in the specifications section of this document.

To wire the system, first determine which devices will be at each end of the system. All other devices will be connected between these two devices. Wire the bus starting with a selected end device. Connect wires to CAN-L and CAN-H (and ground if used) on this device then connect the other end of these wires to the second control in the system. Connect wires in parallel to the wires connected to the second device to the third device in the system. Continue making connections until all controls are connected. Always connect GND to GND, CAN-L to CAN-L, and CAN-H to CAN-H. Never place more than two wires in any terminal connection.



The control at each end of the bus must have a terminator installed. The terminator is a two pin jumper located on the circuit board next to the CAN connector labeled CT. Place this jumper only on the first and last control in your system.

During installation, write down the serial numbers of each device connected and description of the location they are in or are responsible for. This will help to simplify system setup later.

Wiring Diagrams

Board and Firmware revisions

This manual makes reference to FX-2 control board printed circuit board (PCB) revisions. The PCB revision is found along the edge of the printed circuit board in white silk screened lettering and starts with PCB-360. PCB-360-00J indicates a revision J circuit board.

Firmware revision is marked on a label placed on the microcontroller integrated circuit on revision L circuit boards. Previous revision boards have no software revision markings and can only be determined by contacting Northern Lights.

Wiring Diagram identification

The included wiring diagrams are organized by board revision and system type. To find the correct diagram for your system, first identify the control board revision used in your system. Use this identifier along with the type of system you have (direct expansion (DX), air handler (AH), fresh air makeup (FAMU), EasyStart) to find the correct wiring. Systems may not include all features shown in the wiring diagrams. Colors are provided for clarity and may not reflect the colors used in your system.

Using contractors

Circuitry on the board may adversely affect the operation of contactors by holding a contactor on when it should be off. This condition should be verified whenever a contactor is used by following the procedure below.

WARNING: AC LINE VOLTAGE CAN BE DANGEROUS OR FATAL IF IMPROPERLY HANDLED.

The following steps involve working directly with AC line power and must only be performed by trained service personnel.

Checking Contactors

1. Disconnect the contactor load from the contactor.
2. Disconnect the display by removing the plug from the display jack on the FX-2 control.
3. Apply power to the board from the AC mains power source.
4. Depress the contactor armature using a non-conductive hand tool. If the contactorarmature releases quickly without any noticeable sticking or hesitation, then noload resistors are required and you can reconnect the contactor load and display.
5. If the armature does not release or sticks before releasing, add load resistors asdescribed in the next section "Installing Load Resistors".

Installing Load Resistors

Installers may add loading resistors of 62k ohms 2 to 3 watts, to the contactor coil to prevent contactors from remaining on. One load resistor is also required for Chiller controls when a pump relay is connected to the fan output. These resistors are available from standard electronics outlets.

1. Disconnect AC power from the board.
2. Add one or two 62K ohm 2 to 3 watt resistors in parallel to the contactor coil.
3. Recheck the contactor as described in the "Checking Contactors" section.
4. If adding six or more resistors does not significantly reduce sticking or hesitation, contact Northern Lights for additional assistance.

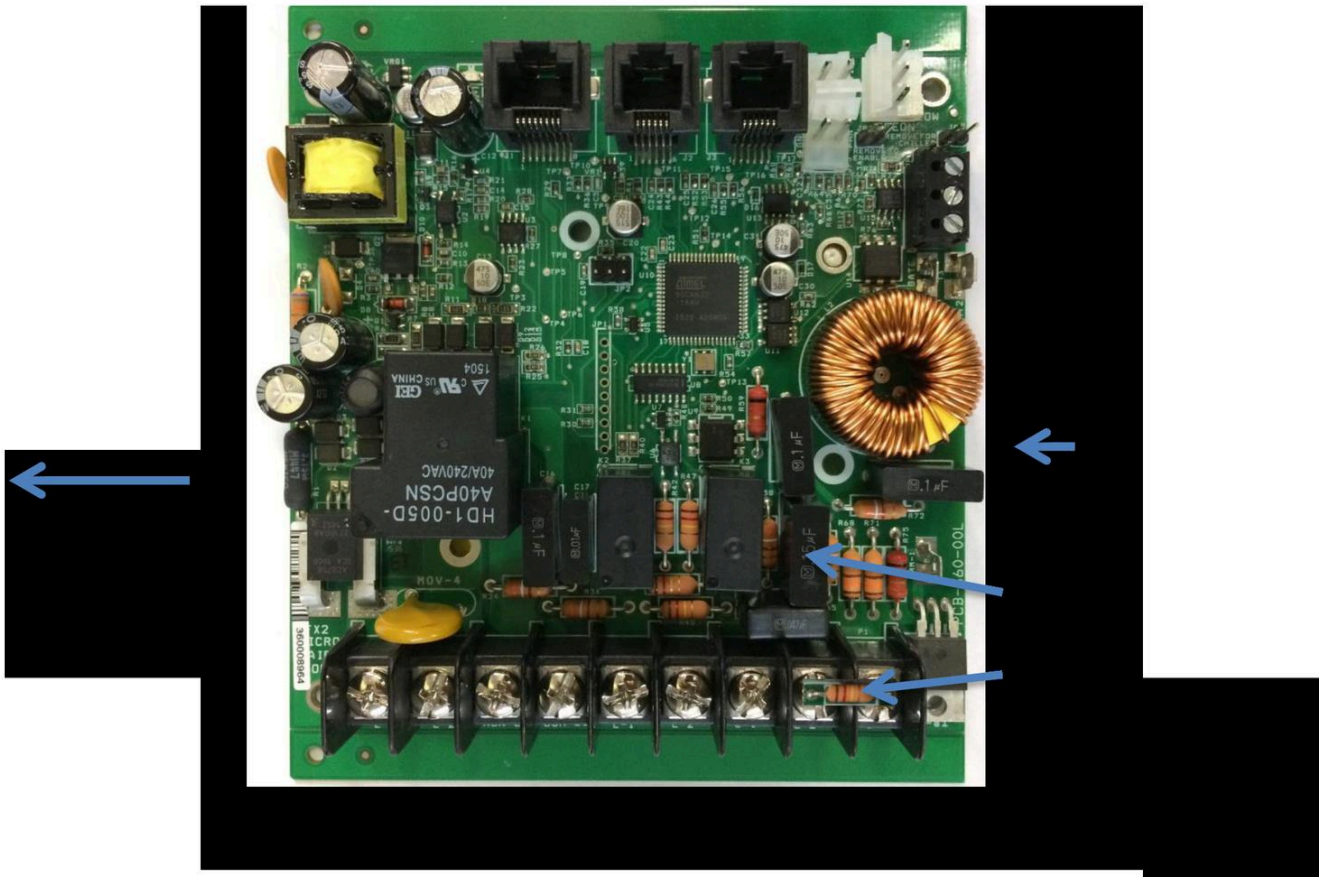
Using Solid State Relays (SSR)

Circuitry on the board may adversely affect the operation of an SSR by holding an SSR on when it should be off. Customers with applications using an SSR should contact Microair prior to purchase for factory modification of the board. Boards may also be returned to Northern Lights for modification.

Using a Pump Relay with a Chiller

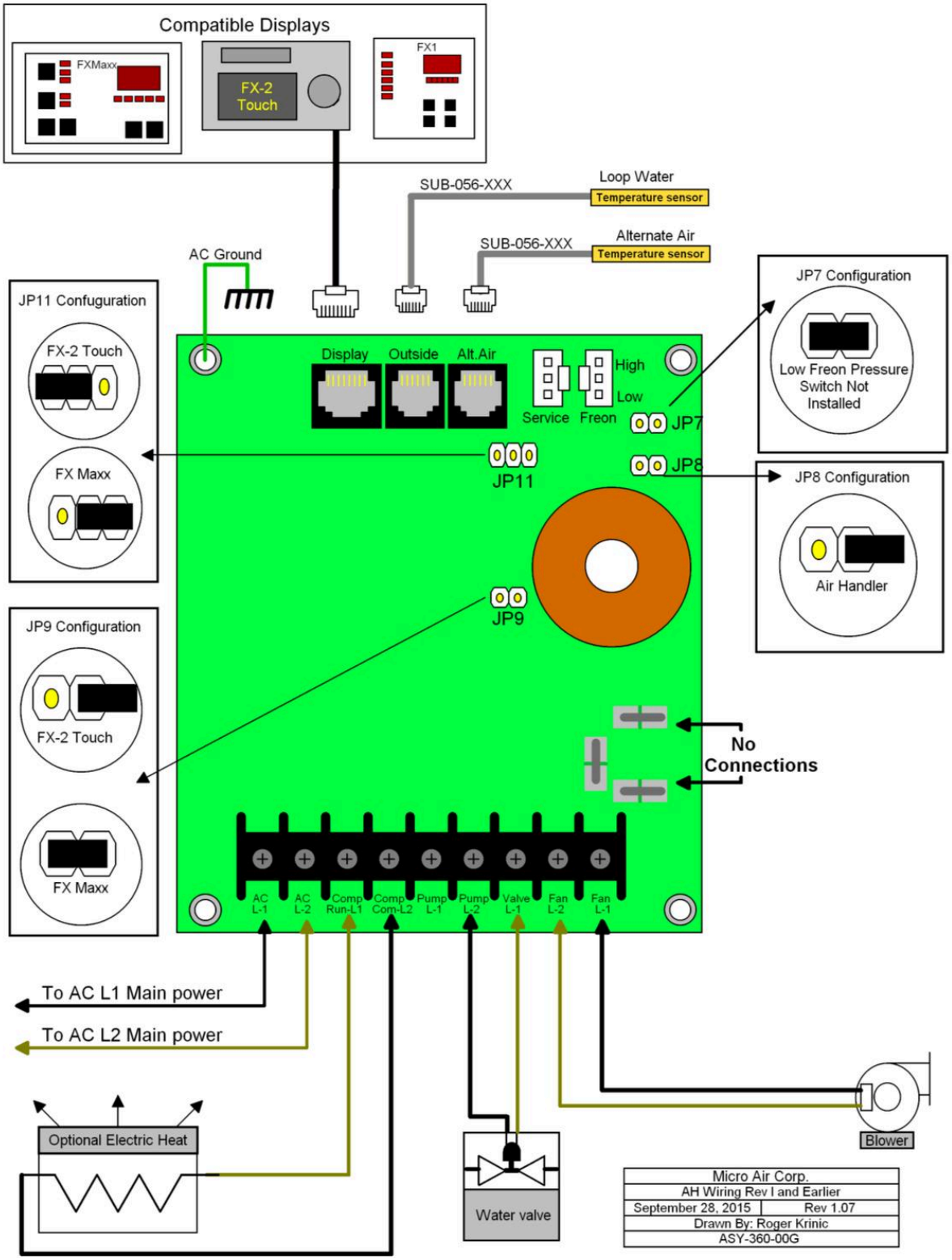
The following information is provided for identification of modified boards. Northern Lights recommends customers call Northern Lights and order a board specifically modified for their application needs. Improperly modified boards and other customer damages are not covered by the Northern Lights product warranty.

These modifications are valid only on revision L printed circuit boards.

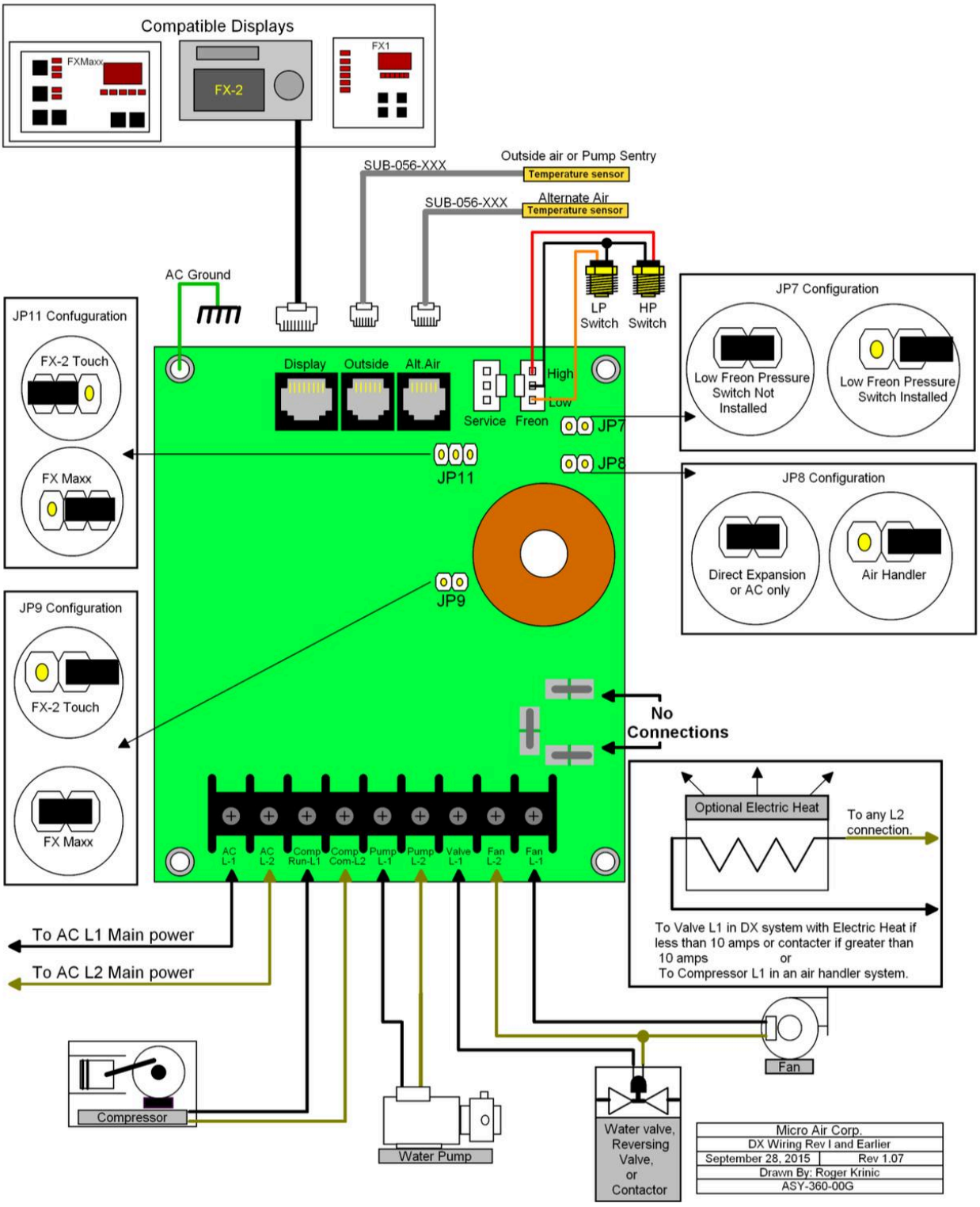


Rev I and Earlier

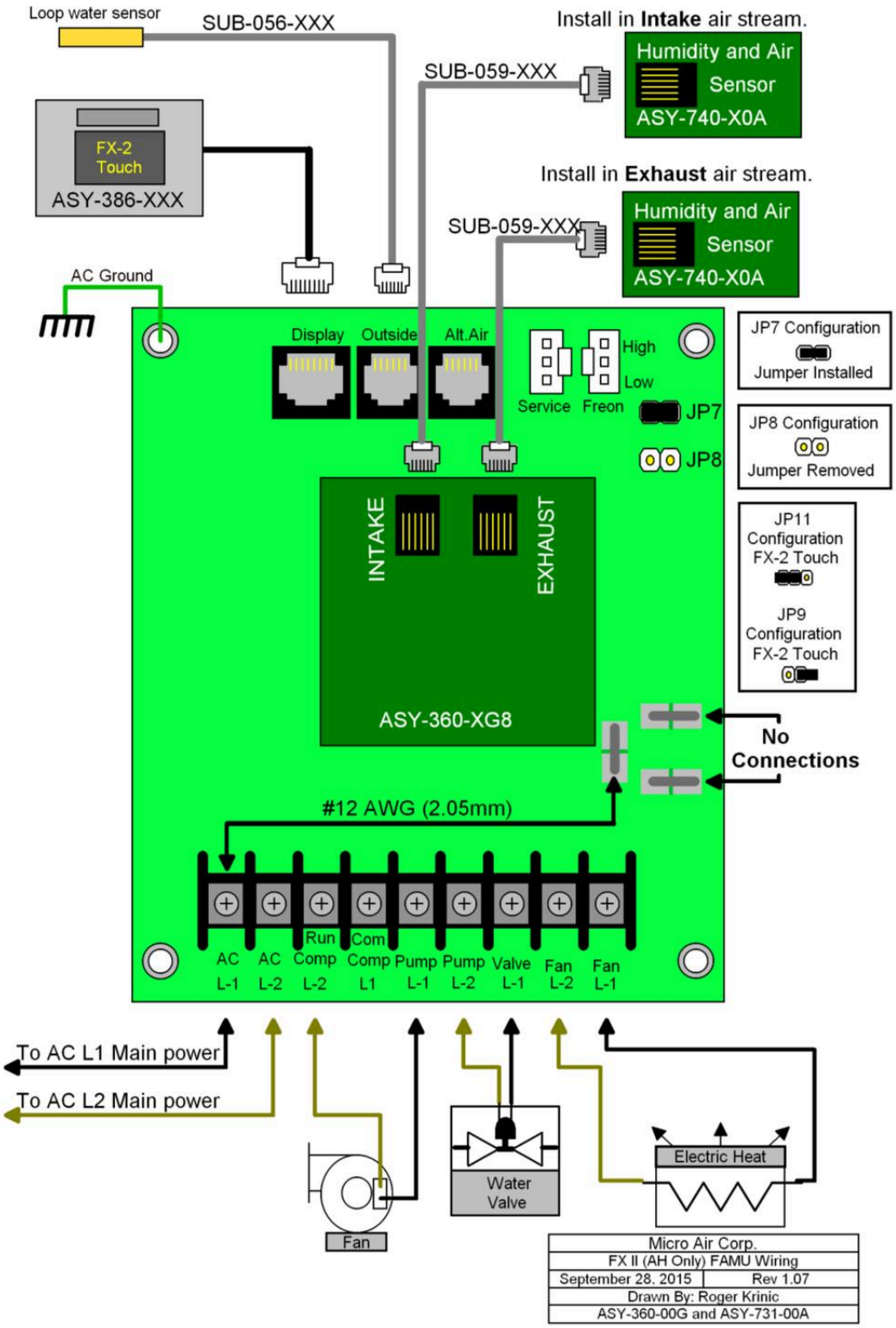
Air Handler (AH): Rev I and Earlier PCB



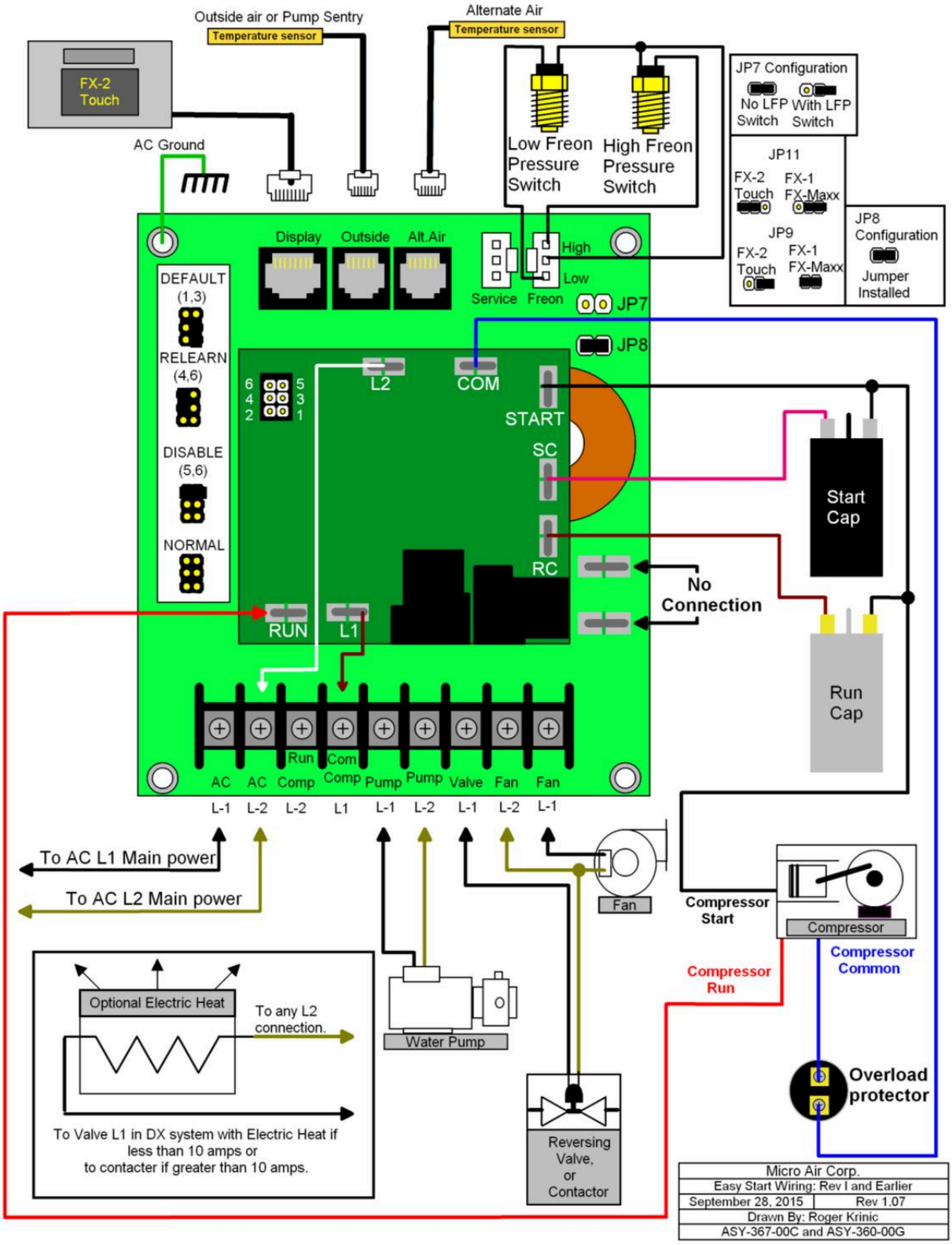
Direct Expansion (DX) Wiring: Rev I and Earlier PCB



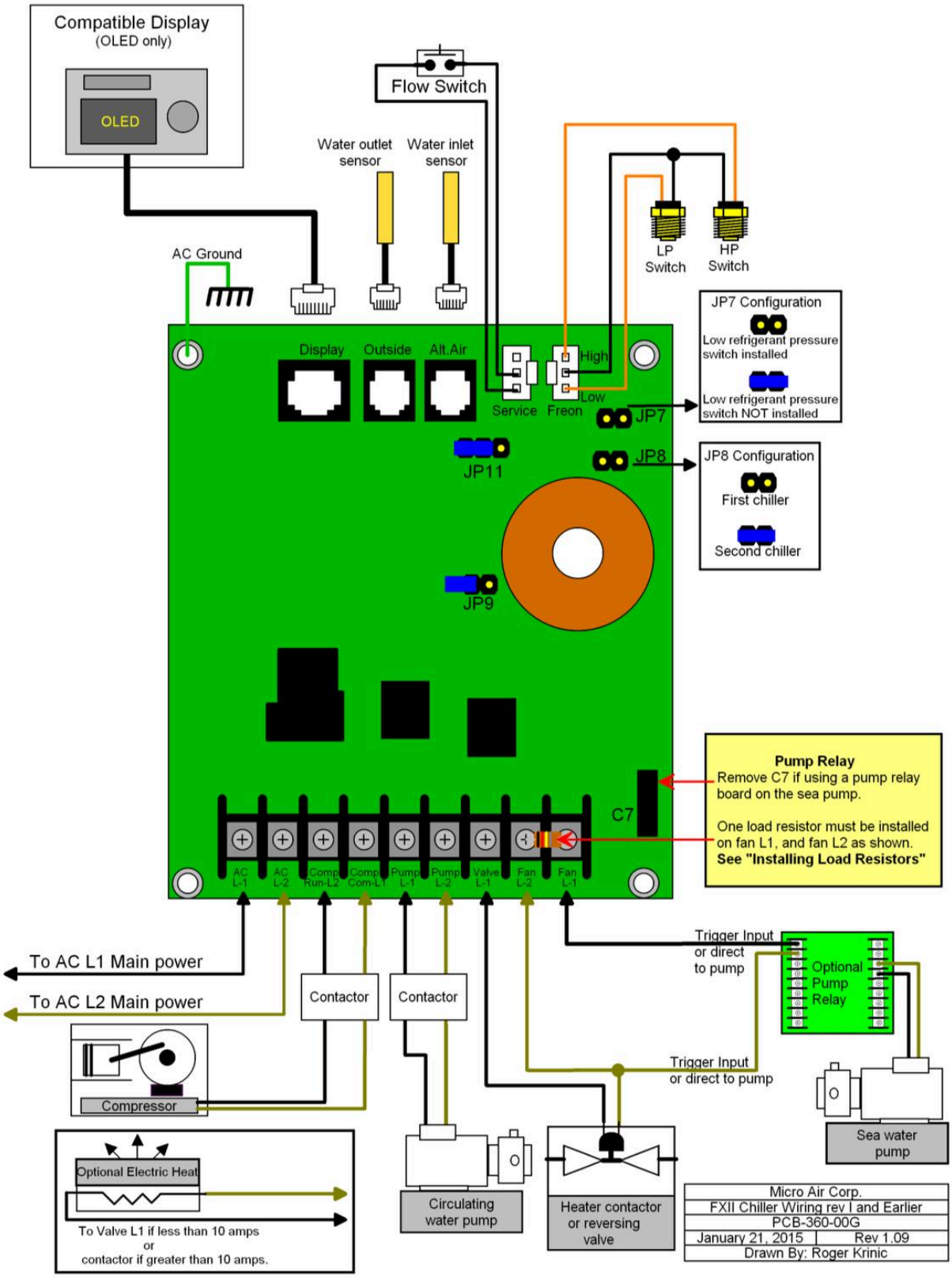
Fresh Air Makeup Unit Wiring (FAMU) Rev I and earlier PCB



EasyStart Wiring: Rev I and Earlier

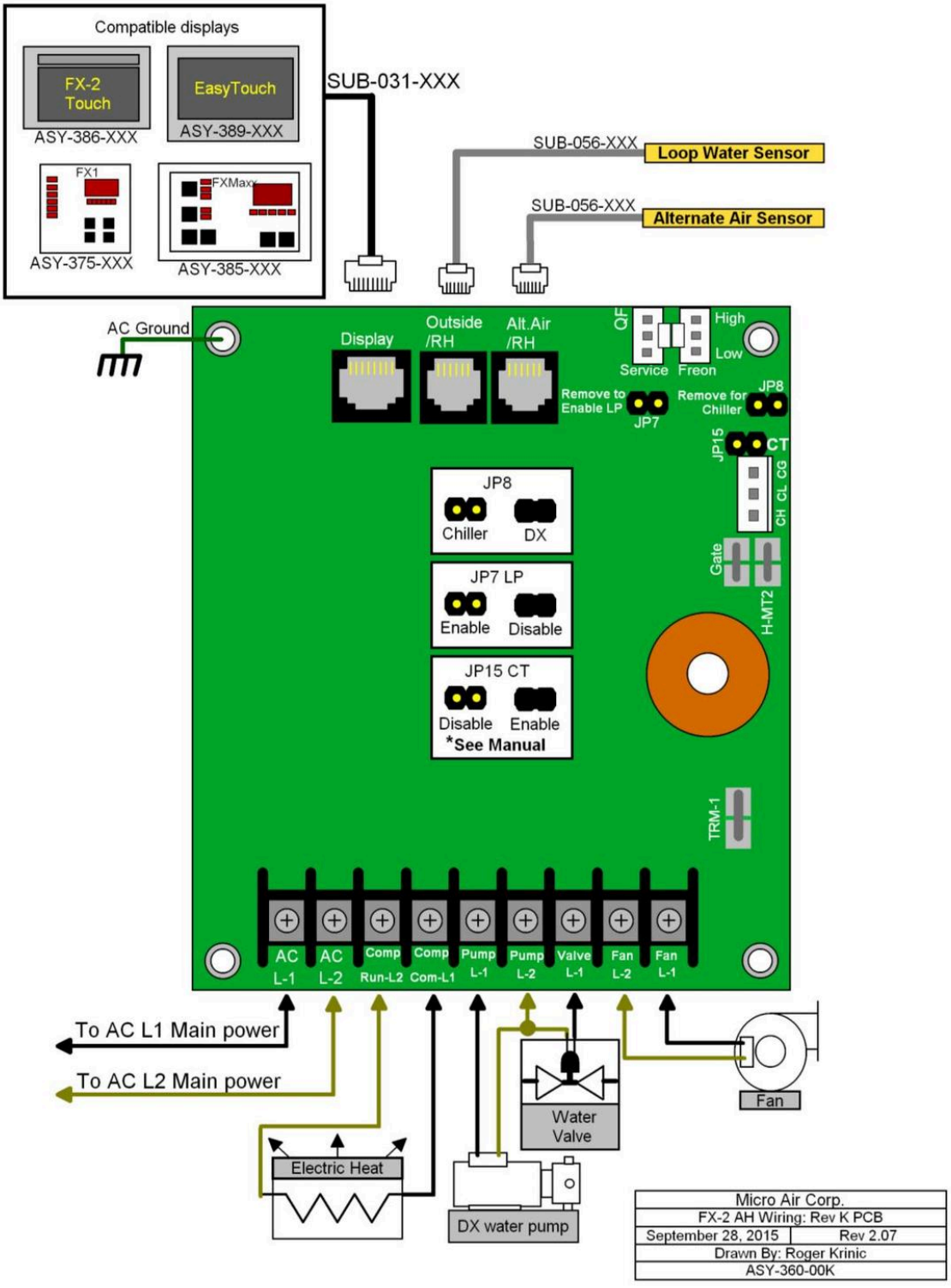


Chiller Rev I and Earlier

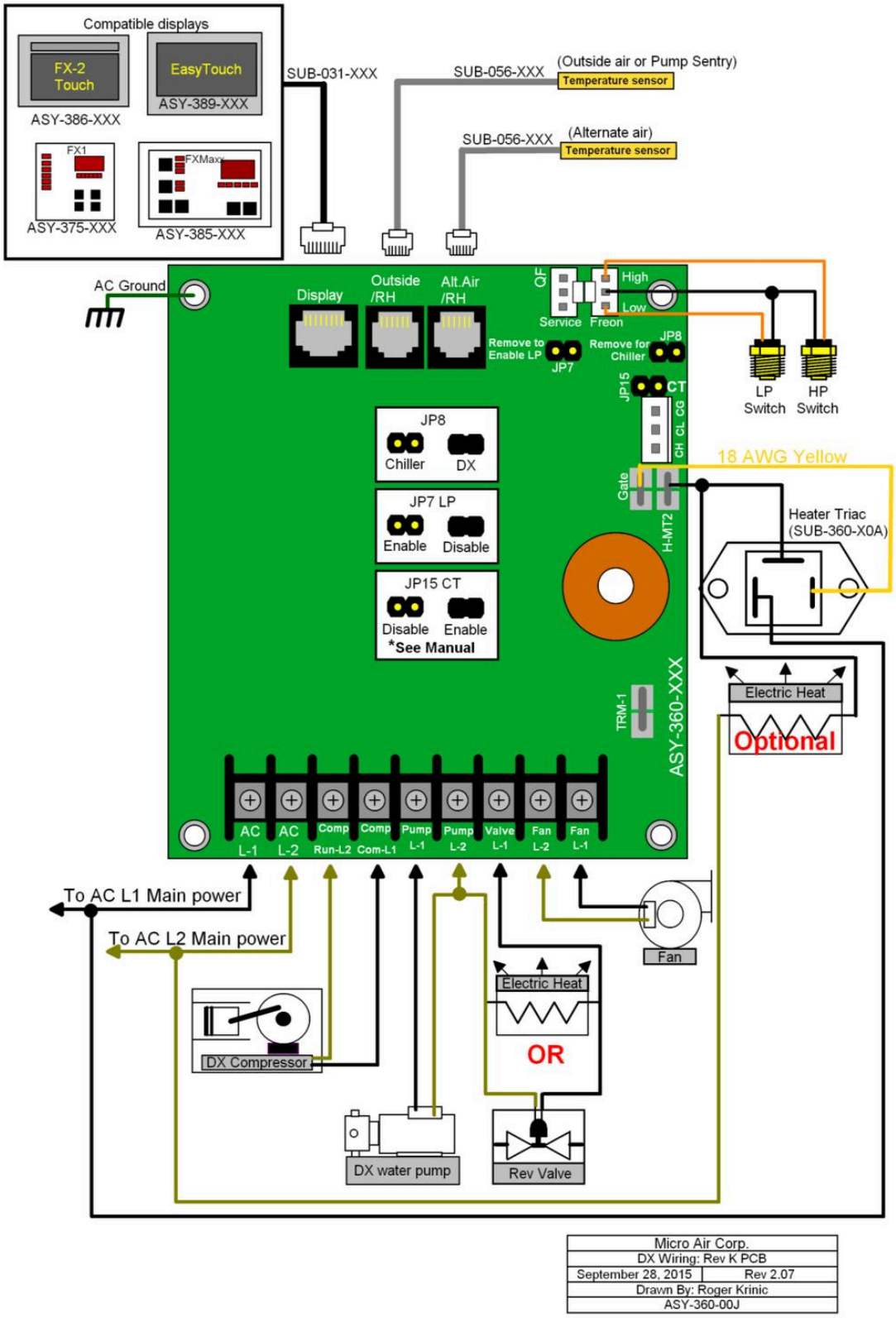


Rev K PCB

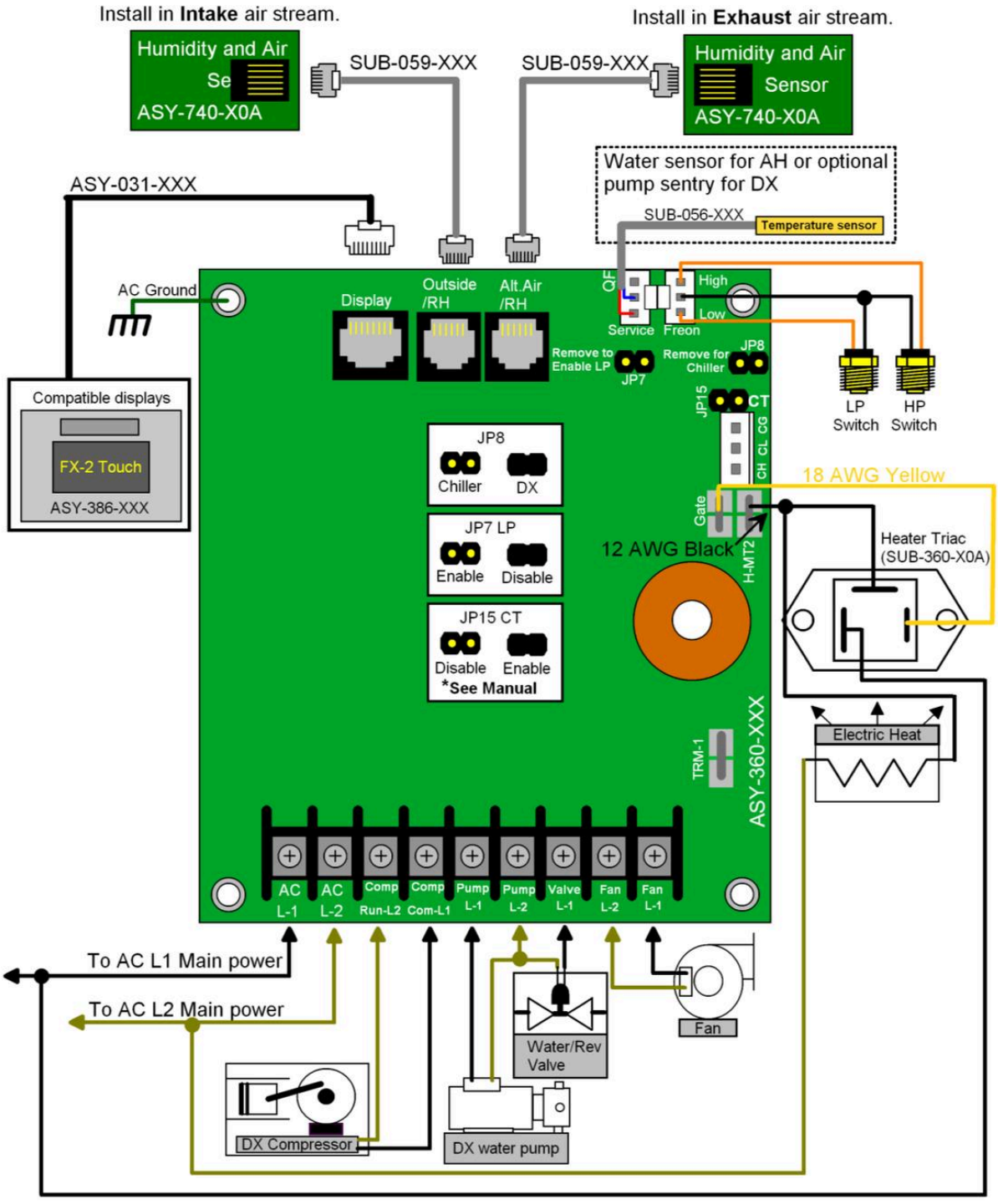
Air Handler (AH) Wiring: Rev K PCB



Direct Expansion (DX) Wiring: Rev K PCB



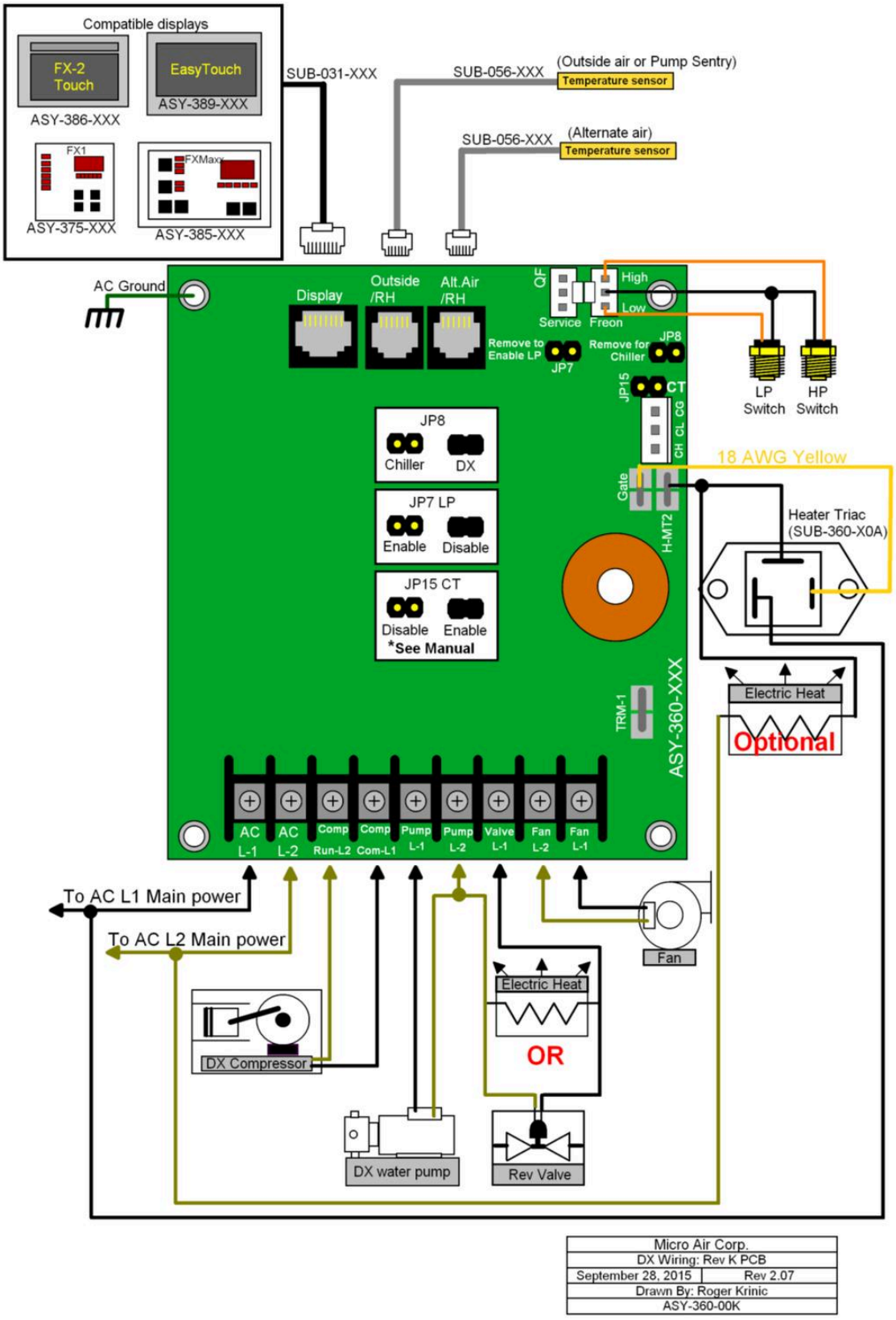
Fresh Air Makeup Unit (FAMU) Wiring: Rev K PCB



[No pump, compressor or pressure switch connections with chiller operation.] [DX must use 386 D31 or higher]

Micro Air Corp.	
FAMU Wiring: Rev K PCB	
September 28, 2015	Rev 2.07
Drawn By: Roger Krinic	
ASY-360-00J	

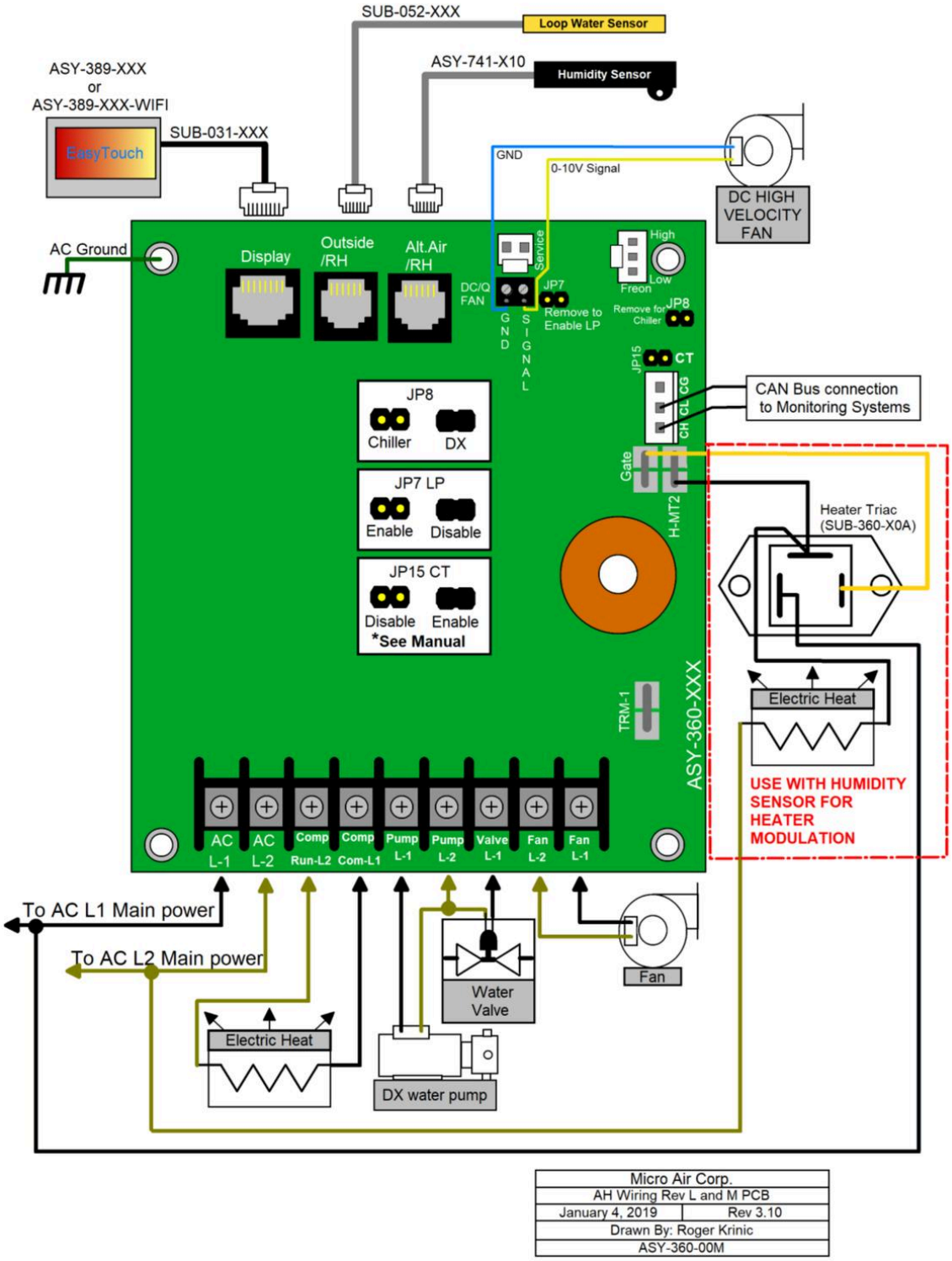
EasyStart Wiring: Rev K PCB



Rev L and M PCB

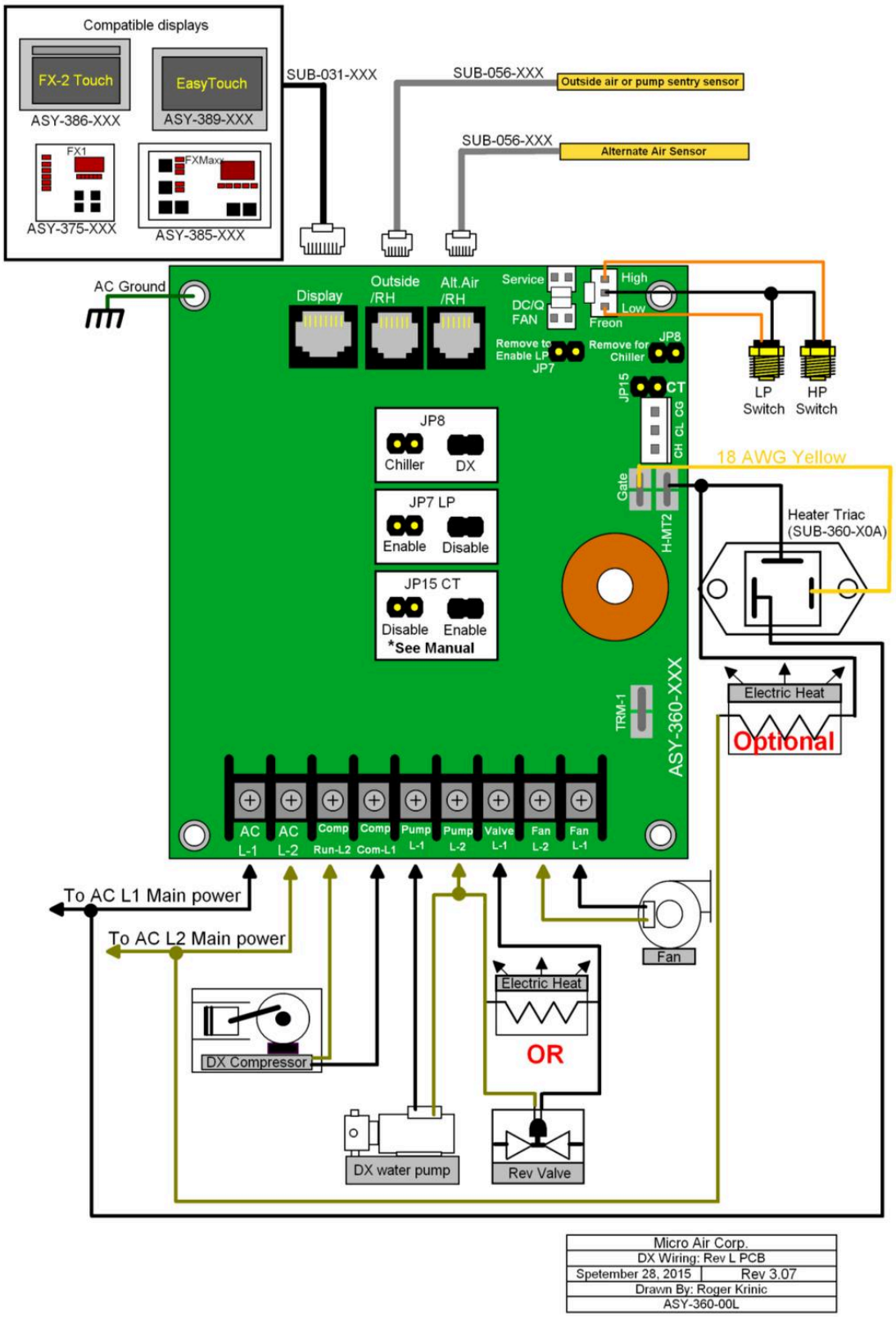
Air Handler (AH) Wiring: Rev L and M PCB

(Rev M shown. Rev L has different style DC fan jack.)



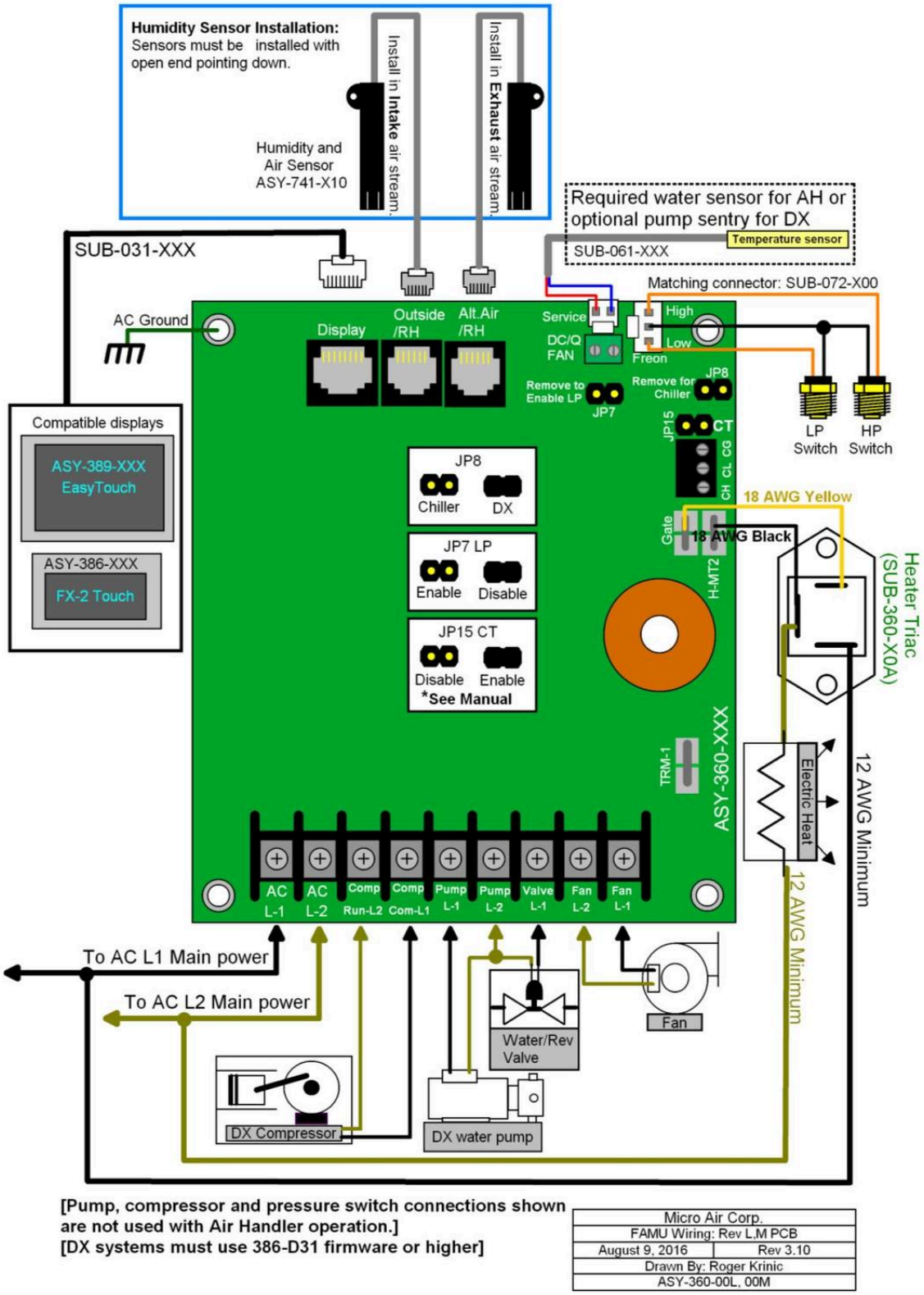
Direct Expansion (DX) Wiring: Rev L and M PCB

(Rev L shown. Rev M has different style DC fan jack.)



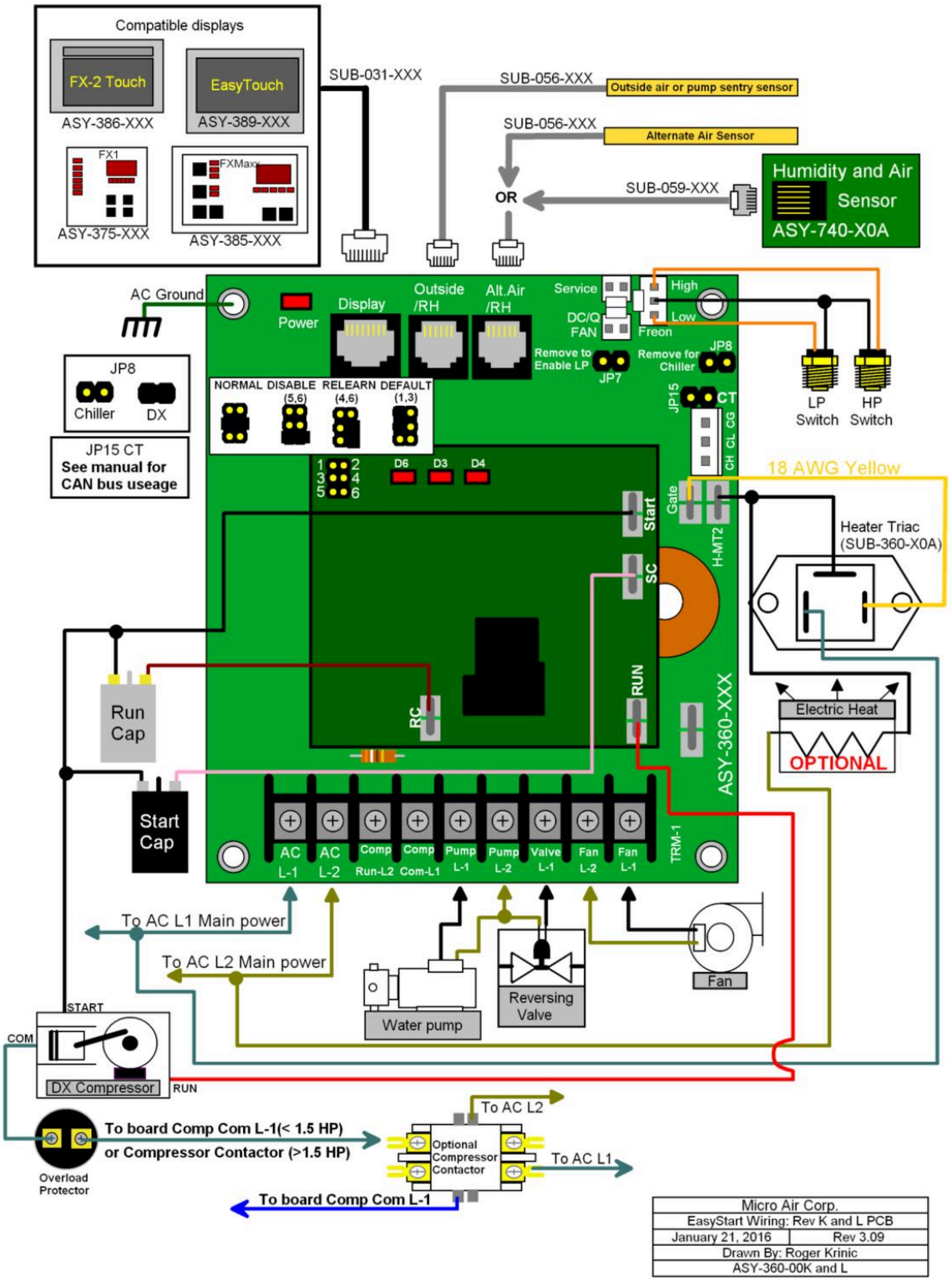
Fresh Air Makeup Unit (FAMU) Wiring: Rev L and M PCB

(Rev M shown. Rev L has different style DC jack.)



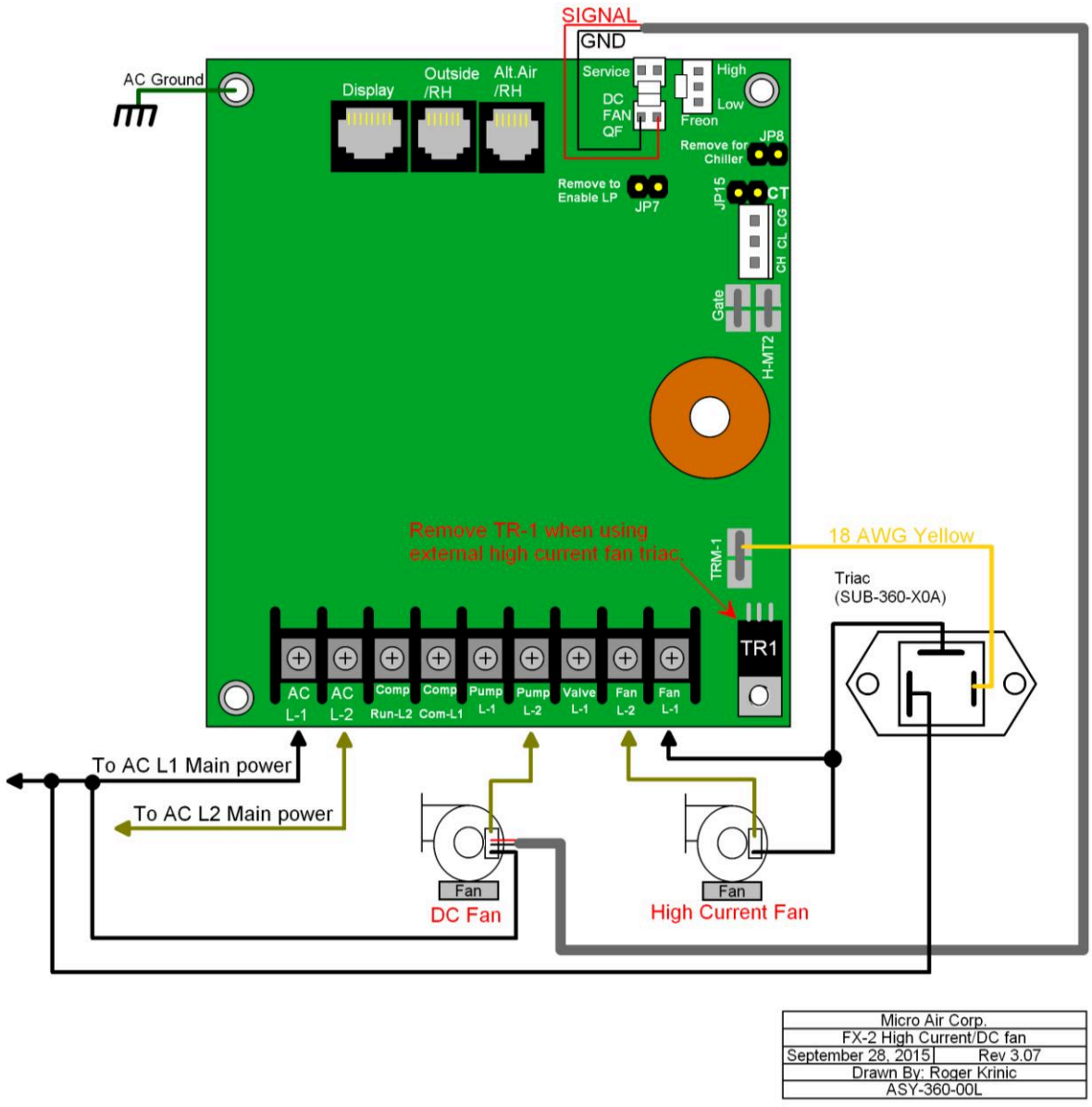
EasyStart Wiring: Rev L and M PCB

(Rev L shown. Rev M has different style DC fan jack.)



High Current and DC Fan Wiring: Rev L and M PCB

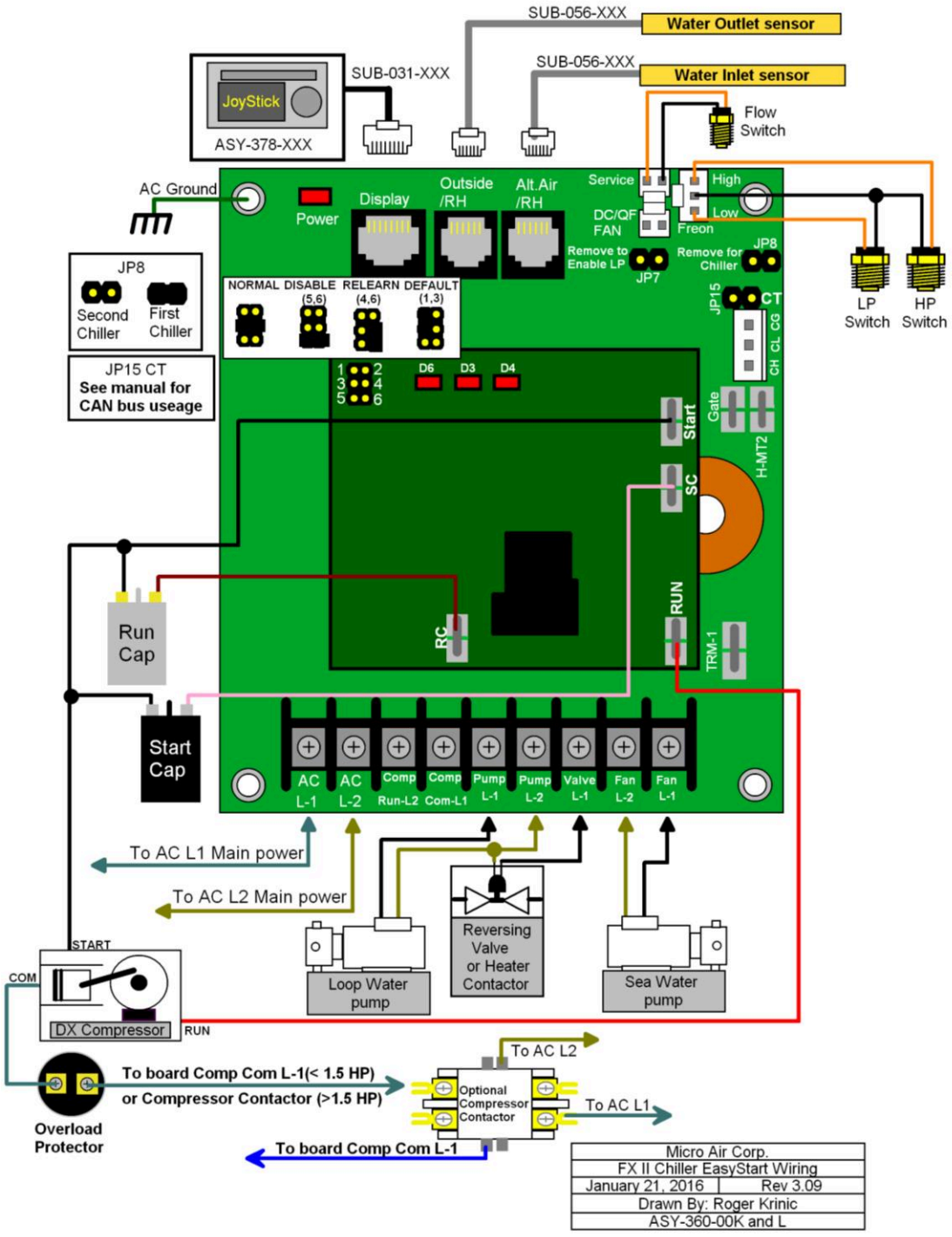
(Rev L shown. Rev M has different style DC fan jack.)



Note: *Up to two DC fans can be connected to the DC fan output.*

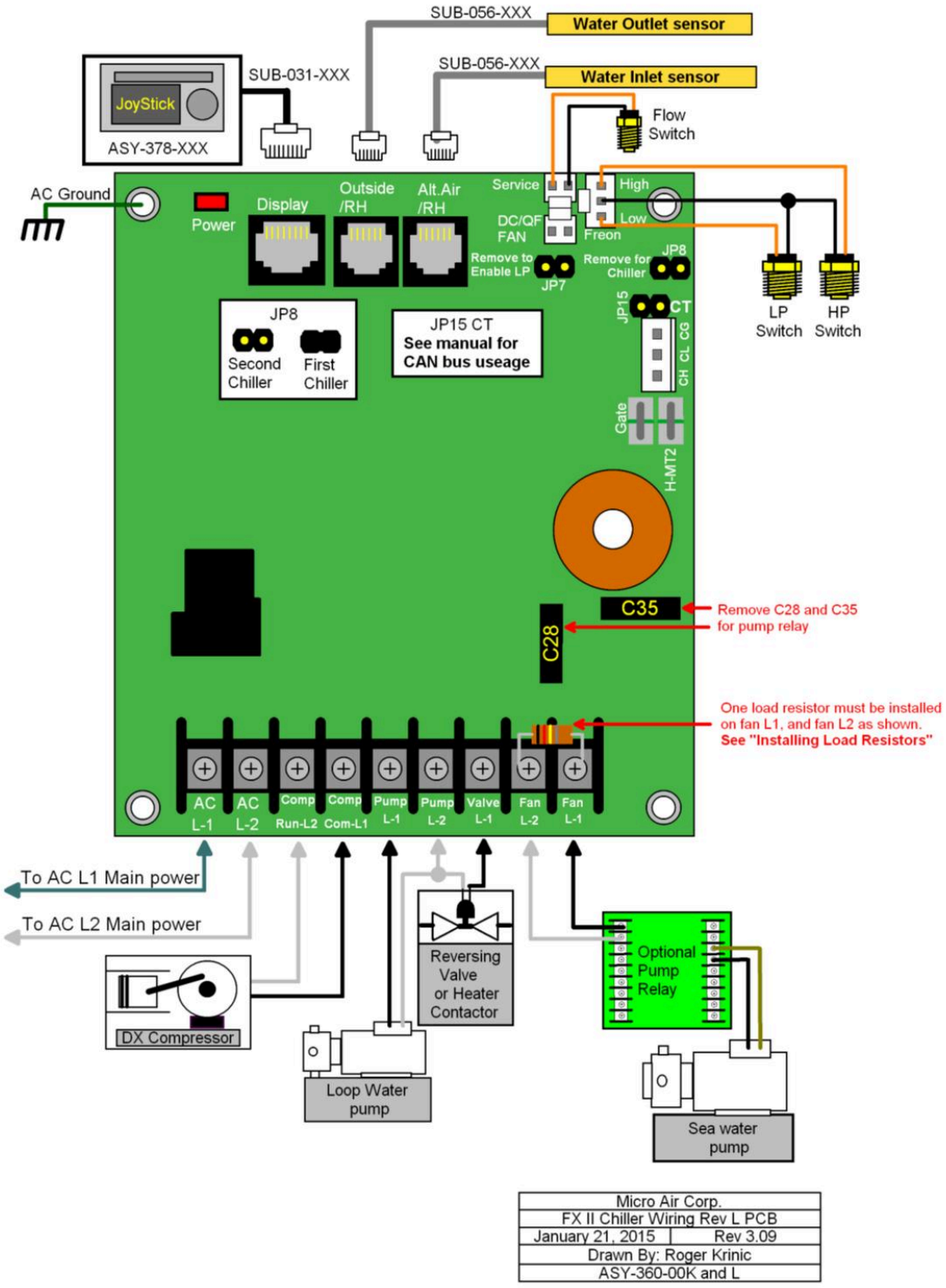
Chiller Control with EasyStart Rev L and M PCB

(Rev L shown. Rev M has different style DC fan jack.)



Chiller Control Rev L and M PCB

(Rev L shown. Rev M has different style DC fan jack.)



Temperature sensor accuracy	2°F at 77°F
Low voltage limit 115 VAC units	75VAC
Low voltage limit 230 VAC units	175VAC
Line voltage limit	250VAC
Frequency	50 or 60 Hz
Maximum board input current	30 Amps
Minimum operating temperature	0°F
Maximum operating temperature	180°F
Maximum RH conditions (Board and display) Maximum length of the display cable Maximum length of the Outside air sensor cable Externally mounted heater or fan triac	95 % Non-condensing 75 Feet 50 Feet 16 Amps
Fan output MAX filtered	6 Amps
Unfiltered Valve output MAX (Or electric heater connected to valve output) Pump output MAX	16 Amps with external Triac 10 Amps Maximum
Compressor output	¼ HP at 115 VAC ½ HP at 230 VAC 1HP at 115 VAC 2HP at 230 VAC
Rev J PCB and above: Heater	16 Amps with external Triac
Electric heater output	

Rev IPCB and earlier (Connected to compressor L1 and L2) 30 Amps
Maximum Rev J PCB and above:

Heater (see wiring)	16 Amps with external Triac 30 Amps: compressor output
Valve output	10 Amps Maximum
MAX Fan output MAX	6 Amps

(CONTINUED)

RH measurement range	5% to 100%
Electric heater output:	
Rev I PCB and earlier (Connected to Fan L1 and L2) Rev J PCB and above:	16 Amps Maximum 16 Amp with external Triac
Valve output MAX Fan output MAX	10 Amps Maximum
Rev I PCB and earlier (Connected to Pump L1 and L2) Rev J PCB and above (Connected to Fan L1 and L2)	10 Amps Maximum 6 Amps Maximum 16 Amps with external Triac

Flat (oval) multi-conductor shielded modular type cable consisting of stranded tinned copper conductors with thermoplastic insulation and a 22 AWG stranded fused tinned copper drain wire with an overall 100% coverage aluminum/polyester shield in a PVC jacket. Five conductors are used for the sensor cables and seven conductors for display cables with 26 AWG 7/36 strand wire covered with .009in (Nominal) insulation. Adirondack wire and cable type AWC195 or similar type cable.

Compatibility: SAE J1939
Characteristic impedance: 120 ohms
Line capacitance: < 80pF per meter at 1 MHz
Wire gauge: 20 AWG minimum
Specific line delay (velocity factor) : > 70%
Mechanical: 2 conductors, twisted pair with shield and drain connection.

Examples of acceptable wire:
North Wire Data Cell J1939

Waytec CB20-11F 20

Prestolite Wire SAE1939-15

#149812