Electrical Installation Requirements

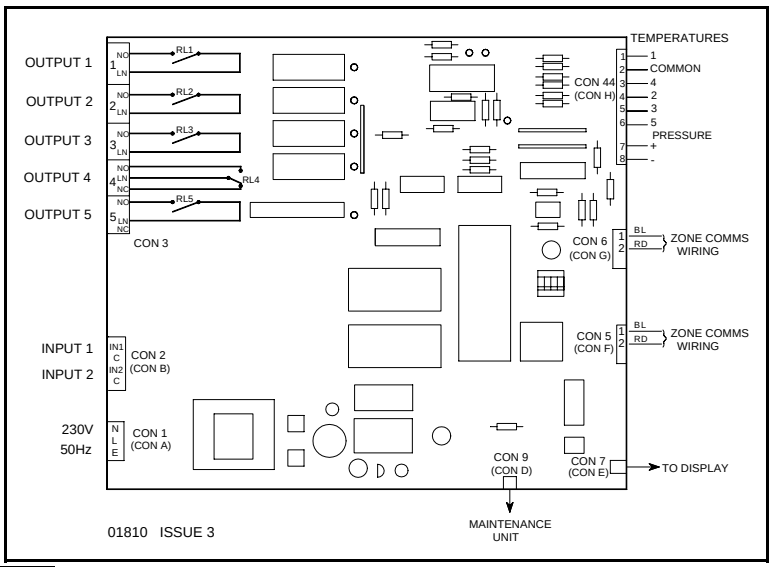
Care should be taken to separate the power and signal cables to prevent electrical interference and possible damage due to inadvertent connection.

The power outputs are fitted with suppressors to protect against electrical interference when switching off solenoid valves or contactors. It is therefore essential to observe the output polarity. The line voltage should be connected to the terminals marked **LN** and the switched loads to **NO** or **NC**.

The plant inputs are electrically isolated. A line voltage should be connected for the logical conditions **lighting override** and **defrost on.** The terminals marked **C** should be connected to the supply voltage neutral.

CE Conformance

This unit conforms with the relevant EU standards when installed according to the JTL Installation Requirements for this product.



Inputs

Input (Connector B)			
IN1 C	INPUT 1	(LINE) (NEUTRAL)	DEFROST ON
IN2 C	INPUT 2	(LINE) (NEUTRAL)	LIGHTING OVERRIDE
Temperatures and Pressure (Connector H)			
1	TEMP 1		AIR ON
2	COMMON		
3	TEMP 4		SUCTION LINE
4	TEMP 2		AIR OFF
5	TEMP 3		EVAPORATOR
6	TEMP 5		TERMINATION
7	PRESSURE +		SUCTION LINE
8	PRESSURE -		

Outputs

Outputs (Connector C)			
1 NO 1 LN	OUTPUT 1	(N/O LOAD) (LINE)	LIGHTING & BLINDS CONTACTOR
2 NO 2 LN	OUTPUT 2	(N/O LOAD) (LINE)	FANS / HEATERS
3 NO 3 LN	OUTPUT 3	(N/O LOAD) (LINE)	TRIM HEATER
4 NO 4 LN 4 NC	OUTPUT 4	(N/O LOAD) (LINE) (N/C LOAD)	DEFROST
5 NO 5 LN	OUTPUT 5	(N/O LOAD) (LINE)	LIQUID SOLENOID OR PULSED EXPANSION VALVE
5 NC	NOT USED		

Use of Maintenance Unit

The controller can be checked and the operation adjusted using a JTL portable maintenance unit which plugs into the controller. Each item of information has an item number. The more important items are listed in the tables overleaf.

Examples:

To read item 21 press: ITEM 2 1 ENTER

To set item 30 to -20.0 press:

ITEM 3 0 ENTER SET – 2 0 0 ENTER

To correct errors press: CANCEL

To select next or previous items press: + and –

Initial Commissioning and Bitswitch Settings

The controller has 4 sets of data built in to its program for use during commissioning. These can be accessed by setting the bitswitches as shown in the table overleaf and then setting item 9 to 1234. This loads into the controller a suitable set of data for the selected type of case. Adjustments should then be made as necessary. The range over which the settings can be adjusted is also defined by the bitswitch setting.

If a JTL communications network is connected to the controller then the unit number should be set on item 1.

Temperature Display

The temperature displayed is computed from the air on and air off temperatures. A factor is used to proportion the air off and air on temperatures.

The temperature can be displayed in celsius or fahrenheit as selected by item 122.

The LCPC controller will drive the following JTL displays when used with the extension cables shown in the table.

The LCD6, LCD7 and LCD9 displays incorporate a keyswitch. This switch can be used to select various functions as described below. A maximum of 2 additional functions can be selected. On LCD6 and LCD9 if only one additional function is selected, then it is available in either of the extra 2 positions.

Display	Cable	Switch	Item 129
LCD6	CAB34	3 position	LCD1 (2)
LCD7	CAB34	2 position	LCD1 (2)
LCD9	CAB51	3 position	LCD8 (3)

The cables are available in various lengths.

Control Strategy
The air off temperature is controlled to a computed setpoint shown on item 28, by controlling either a pulsed expansion valve or liquid line solenoid valve with a mechanical expansion valve. The choice is selected on item 160.

The computed air off temperature setpoint is calculated by comparing the displayed temperature with the cabinet temperature setpoint. The computed setpoint is raised or lowered depending on whether the cabinet temperature is below or above the cabinet temperature setpoint. The computed air off setpoint cannot go below the value set on item 31.

The LCPC controller can be set to operate from 2 cabinet temperature setpoints by setting item 123. The setpoint to be used is then selected using the display keyswitch. The setpoints are set on items 124 and 125 and the current setpoint is displayed on item 30. If no switch is selected then setpoint 124 is used.

For liquid solenoid control, if the air off temperature falls below the computed setpoint the liquid valve is closed. There is a deadband of ± 0.2 C.

For pulsed expansion valve control, the valve opening is controlled primarily using a PI strategy on the air off temperature. The valve is opened and shut over a fixed period of time (normally 6.25 s) to meter the appropriate amount of refrigeration. The proportional gain and the integral time constant for the PI control are adjustable.

On PEV control, if the superheat falls below the minimum level set on item 162 or 186, the PEV is progressively shut to effect recovery from excess liquid supply. This is called override.

After override is complete, ie. superheat recovers, PI control will be resumed but with a modified (reduced) value. The modifier is shown on item 190 and the output to the PEV valve is shown on item 168.

The superheat is calculated using the suction pressure and temperature. A backup strategy uses the evaporator and suction line temperatures to calculate the superheat.

Defrost Strategies
The defrost strategy can be initiated in 4 ways using item 107. Defrost initiation can be by real time clock, by deduction from the suction temperature, by command on the JTL communications network, or by contact input.

There is a choice of 2 methods of defrost operation, termination or control, using item 75. In termination mode the defrost output relay is energised during defrost recovery period and at any time when the termination temperature is exceeded. In control mode the defrost output relay is energised during the defrost period.

The liquid solenoid or PEV is closed during all forms of defrost. The auxiliary output can be selected for fan or heater control. During defrost the fans can be stopped or the auxiliary heater energised.

For network, real time and contact initiated defrost a pump down delay can be applied (item 61) before the defrost/output and heater are energised. During pump down the liquid outputs are de-energised.

For network initiated defrost, 2 defrost backup strategies are included. The strategy choice is made on item 107. For learned backup the last 24 hours defrost operation is continuously monitored and the defrost schedule is learned. For real time backup the defrost schedule as set up for real time defrost on items 51-56 is used. If network communication fails, the selected backup strategy is automatically used. The unit reverts to network control whenever the network communications is operational.

The backup strategy is also invoked if the network signals that communications has failed to the defrost scheduler, or that there is a fault on the defrost scheduler.

The controller stays in defrost at least until the minimum defrost time, on item 145, is exceeded. If the termination temperature is reached before the minimum defrost time then the defrost heater is cycled.

The display shows "dEF "

NOTE: No suction initiated defrost can be detected within 3 hours of the previous defrost.

Defrost Recovery
When the termination temperature or time is reached the controller enters defrost recovery. The heater is de-energised. The termination method can be chosen using item 144.

For network, real time and contact initiated defrost a time delay can be applied (item 49) after defrost before the liquid valve is reopened.

A drain down time delay can be applied (item 59) after defrost before the liquid valve is reopened. During drain down if the auxiliary heater output is selected it is energised.

During defrost recovery the fans can be controlled depending on the evaporator temperature or time delay after defrost. If item 109 is set to 00:00, when the evaporator temperature is low enough, the fans start. There is a 5 degree deadband. The display shows "dEFr". If the item 109 is set to a time then the fans are held off until the time delay has occurred.

Forced Refrigeration and Defrost
The maintenance unit can be used to force controller into a particular mode. This is done using items 77-79. While the maintenance unit is plugged in the controller will remain in the selected mode permanently. Once the maintenance unit is unplugged the controller will revert to normal control after 30 minutes.

When the network initiated defrost strategy is selected, forced defrost will send a command to the JTL defrost scheduler to initiate a defrost and does not act locally.

Lighting and Night Blind Control
The cabinet lights and night blinds can be sequenced on and off by command from the JTL network. An override switch input facility is provided which raises the blinds and turns the lights on.

The lights can be switched off from the display keyswitch if item 119 is set to 1 (enabled). The lights are then switched off if either fans only or shutdown are selected.

Energy Saving - Fan Control
If energy saving is selected using item 130, then the fans will be cycled during normal refrigeration. When the energy saving temperature, item 131, goes below the energy saving setpoint, item 132, the fans stop. There is a deadband of ±0.5°C

High Temperature Alarms
The cabinet and air off temperatures are monitored continually. The temperatures are averaged over the period set on item 47. If either of the average temperatures exceeds the alarm level then an alarm is given which is shown on the display and available, for remote indication, on the JTL alarm system. High temperature alarms are cancelled during defrost and defrost recovery.

The cabinet temperature tolerance is set on item 32 and the air off tolerance on item 34. Setting either of these tolerances to 0.0°C disables the relevant alarm.

Excessive Superheat Alarms (PEV control only)
If the measured Superheat exceeds 50°C then a sensor fault is assumed and the maximum opening of the expansion valve is reduced to 50% of the maximum allowed. When the measured Superheat is between 30 and 50°C the fault condition is activated if the suction temperature exceeds the air on temperature.

Network Shutdown and Fans Only Mode
This controller supports the JTL Network shutdown and fans only facilities. When these facilities are enabled by item 62. If a shutdown or fans only command is received over the JTL Network, the refrigeration is stopped and alarms are disabled. The high temperature alarm sequence is initialised.

Display Controlled Shutdown
The controller can be shutdown for servicing purposes using the display switch. This feature is enabled by item 138.

Display Controlled Fans Only Mode
The controller can be put into fans only mode using the display switch. This feature is enabled by item 136.

Suction Pressure Optimisation
When used in conjunction with JTL pack control and suction optimisers this unit is normally included in the suction pressure optimiser algorithm. It can be explicitly excluded when both air sensors are faulty by setting item 200 to 1.

Daylight Saving
When connected to a JTL network this controller can operate by displaying daylight saving time for its time and defrost schedule. Daylight saving operation is selected by setting item 18. The connected network controller then adjusts the times automatically during the daylight saving period.

ADJUSTABLE PARAMETERS				LCPC
Item	Function	Range	Units	Bitswitch settings
1	Unit number	0.1 to 899.9		4321
18	Daylight saving operation	0=standard time 1=daylight saving time		xxCC Frozen food
31	Air off temperature setpoint	-39 to +5	°C	xxCO Ice cream
32	Cabinet overtemperature tolerance	0 to +20	°C	xxOC Chillers
33	Cabinet temperature factor	20 to 80		xxOO Produce
34	Air off over temperature tolerance	0 to +30	°C	
36-39	Probe selections	0=off 1=on		where
47	Alarm averaging time	00:30 to 03:00	hr:mn	C = closed
48	Compressor starts/hour	unlimited /10/15/20		O = open
49	Refrigeration delay after defrost	00:00 to 00:10	hr:mn	x = don't care
50	Defrost termination temp (air off)	0 to +20	°C	
51-56	Defrost schedule	00:01 - 23:59	hr:mn	closed = dot visible
57	Defrost termination time	00:05 to 01:00	hr:mn	
58	Defrost initiation temp (suction)	-5 to +20	°C	
59	Drain down time	00:00 - 00:10	hr:mn	
60	Defrost schedule 12/24 hour clock	0=24hr 1=12hr		
61	Pump down time	00:00 - 00:10	hr:mn	
62	Network shutdown and fans only commands	0=disabled 1=enabled		
65	Invert defrost input	0=no 1=yes		
69	Number of defrosts expected	0 to 12		
75	Defrost control mode	0=termination 1=control		
106	Auxiliary output selection	0=off 1=Fan 2=Heater		
107	Defrost strategy	0=none 1=Suction 2=Network (learned backup)3=Time 4=Contact 7=Network (real time backup)		
108	Fan control	1=run always 2=off during defrost		
109	Fan delay after defrost	00:00 to 00:10		
110	Lighting control selection	0=off 1=on		
118	Lighting contractor selection	0=n.o 1=n.c		
119	Enable lights shutdown from display	0=disabled 1=enabled		
122	Temperature display choice	0=celsius 1=fahrenheit		
123	Enable 2nd setpoint	0=disabled 1=enabled	°C	
124	Primary cabinet temperature setpoint	-30 to +10	°C	
125	Secondary cabinet temperature setpoint	-30 to +10		
129	Temperature display type choice	2=standard 3=enhanced		
130	Energy saving probe selection	0=off 1=on	°C	
132	Fan control temperature setpoint	-30 to +8		
133	Enable plant to override temp control	0=disabled 1=enabled		
134	Enable plant to cut off refrigeration	0=disabled 1=enabled		
136	Enable fans only mode from display	0=disabled 1=enabled		
138	Enable display controlled shutdown	0=disabled 1=enabled		
144	Defrost termination method	1=Evaporator 2= Air off 3=Termination 4=Time only	hr:mn	
145	Minimum defrost time	00:00 - 00:30		
147	Termination sensor selection	0=Off 1=On		
200	Exclude from suction optimisation	0=include 1=exclude		
PULSED EXPANSION VALVE FUNCTIONS				
157	Refrigerant type	0 - 6 (R type shown on MU display)		
158	Pressure transducers zero offset	-7 to +7	psi	
160	Control valve	0=Liquid solenoid 1=PEV		
161	Control strategy	1=2 temperature 2=pressure		
162	Minimum superheat (pressure)	0 - 10	°C	
163	Maximum valve opening (pressure)	10 - 100	%	
164	Minimum valve opening	0 -50	%	
170	PEV proportional gain	1 - 100		
171	PEV integral time constant	1 - 250		
174	High suction pressure shutdown	0=disabled 1=enabled		
177	Auto zero pressure enable	0=disabled 1=enabled		
179	Pressure display choice	1=psi 2=bar 3=kPa		
186	Minimum superheat (2 temperature)	0 - 5	°C	
187	Minimum valve opening (2 temperature)	5 - 50	%	

OTHER USEFUL ITEMS					
Item	Function	Item	Function	Item	
20	Cabinet temperature	63	Network shutdown and fans only command states	112	Lighting override input state
21	Air on temperature	70	Operating mode	113	Lighting output state
22	Air off temperature	71	Defrost input state	114	Force lights on
23	Evaporator temperature	72	Defrost output state	115	Force lights off
24	Suction line temperature	73	Liquid valve output state	131	Energy saving temperature
28	Effective air off setpoint	74	Auxiliary output state	141	Termination sensor temperature
30	Cabinet temperature setpoint	77	Forced defrost	203	Associated plant suction line
40	Duration of last defrost	78	Inhibit defrost	240	Liquid valve open %
41	Time since end of last defrost	79	Forced refrigeration	241	Average liquid valve open %
42	Duration of this defrost	111	Communications lighting command	261-272	Learned defrost schedule
46	Communications defrost command				

PULSED EXPANSION VALVE FUNCTIONS			
154	Force pressure average to current reading	168	PEV valve opening (%)
155	Suction pressure	169	PEV status
156	Superheat	181	Time since last override (hr:mn)
159	Auto zero offset	182	Duration of last override (sec)
166	Force PEV opening (%)	190	Modifier output (%)

www.jtl.co.uk
JTL Systems Ltd . 41 Kingfisher Court . Hambridge Road . Newbury . Berks . RG14 5SJ Tel: (01635) 263646 Fax: (01635) 263647

JTL Help Desk Tel: 0870 321 HELP (4357)

OUTPUT STATE DIAGRAM FOR JTL CONTROLLER — LCPC

MODE OF OPERATION		OUTPUT & FUNCTION (See note 5)					
		RL2		RL3	RL4		RL5
		AUXILIARY (N/O) can be set to run always [108] See Note 2		**TRIM HEATER (N/O)**	**DEFROST (C/O)**		**LIQUID SOLENOID OR PULSED EXPANSION VALVE (N/O)** Solid state output See Note 1
		ITEM 106			ITEM 75		
		Heater	Fans		CONTROL	TERMINATION	
NORMAL REFRIGERATION CYCLE	**REFRIGERATION**	OFF	ON (See note 3)	ON	OFF	ON ABOVE TERMINATION TEMP	CYCLES ON AIR OFF TEMPERATURE
	PUMP DOWN Adjustable time [61]	OFF	OFF	ON	OFF (from version 0.01.0)	OFF	OFF
	DEFROST Time/temp terminated [57]/[50]	ON	OFF	ON	CYCLES ON TERMINATION TEMP (from version 0.01.3)	OFF	OFF
	DRAIN DOWN Adjustable time [59]	ON	OFF	ON	OFF	ON	OFF
	LIQUID HOLD OFF Adjustable time [49]	OFF	OFF	ON	OFF	ON	OFF
	RECOVERY TIME Time/temp terminated	OFF	TEMPERATURE OR TIME CONTROLLED (See Note 6)	ON	OFF	ON	CYCLES ON AIR OFF TEMPERATURE
	REFRIGERATION	OFF	ON (See note 3)	ON	OFF	ON ABOVE TERMINATION TEMP	CYCLES ON AIR OFF TEMPERATURE
PLANT FAULT		OFF	OFF	ON	OFF	ON	OFF
UNIT SHUTDOWN		OFF	OFF	OFF	OFF	OFF	OFF
FANS ONLY SHUTDOWN		OFF	ON	OFF	OFF	OFF	OFF
FORCED DEFROST		ON	ON	ON	ON	OFF	OFF
FORCED REFRIGERATION		OFF	ON	ON	OFF	ON	CYCLES (see note 7) ON AIR OFF TEMPERATURE
INHIBIT DEFROST		OFF	ON	ON	OFF	ON	CYCLES ON AIR OFF TEMPERATURE

NOTE 1: SOLENOID OR PULSED EXPANSION VALVE IS OPERATED DEPENDING ON SETTING [160]
NOTE 2: CAN BE SET TO OFF USING ITEM 106
NOTE 3: CAN CYCLE ON ENERGY SAVING TEMPERATURE (SELECTED BY ITEM 130)
NOTE 5: RL1 IS FOR LIGHTING CONTROL
NOTE 6: FANS OFF UNTIL TIME SET ON ITEM 109 REACHED. IF 109 SET TO 00:00 FANS CYCLE ON EVAPORATOR TEMPERATURE
NOTE 7: LIQUID SOLENOID OPERATION ON DURING FORCED REFRIGERATION

Relay Output Rating
2A resistive.

Supply Requirements
230 V ac 48-62 Hz Supply 6 VA maximum inputs 2 mA maximum

CE This unit conforms with the relevant EU standards when fitted in accordance with its installation instructions.

Note The information contained in this document applies to the current version of the unit supplied with it. Full operating manuals, item number and software variation information can be obtained from your supplier or JTL Systems.

Applicable Documentation

Item Numbers Doc No. 02089	Software Variations Doc No. 02090	Wiring Diagrams Doc No. 02085 Doc No. 02086
Evaporator Manual Doc No. 01923	Installation Requirements Doc No. 01662	

www.jtl.co.uk
JTL Systems Ltd . 41 Kingfisher Court . Hambridge Road . Newbury . Berks . RG14 5SJ Tel: (01635) 263646 Fax: (01635) 263647

JTL Help Desk Tel: 0870 321 HELP (4357)