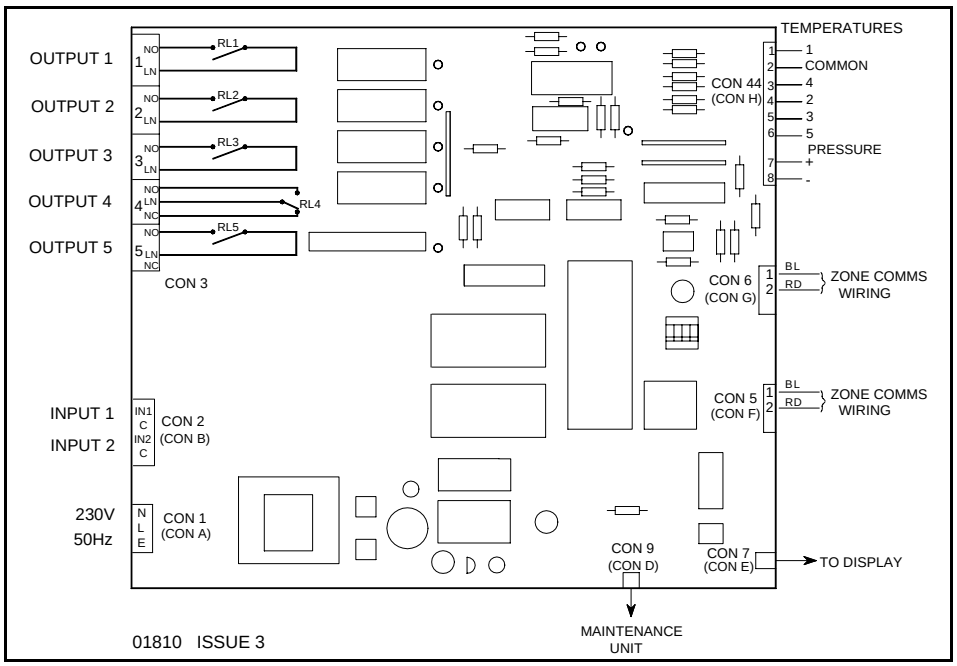
Electrical Installation Requirements
Care should be taken to separate the power and signal cables to prevent electrical interference and possible damage due to inadvertent connection.

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 loads to **NO** or **NC**.

The plant inputs are electrically isolated. A line voltage should be connected for the logical conditions **door closed, defrost on** or **plant alarm**. 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)	DOOR CLOSED
IN2 C	INPUT 2	(LINE) (NEUTRAL)	DEFROST ON OR PLANT ALARM OR SHUTDOWN
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)	PAN HEATER or SUCTION VALVE
2 NO 2 LN	OUTPUT 2	(N/O LOAD) (LINE)	FANS
3 NO 3 LN	OUTPUT 3	(N/O LOAD) (LINE)	LIQUID SOLENOID VALVE
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)	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 display shows the air on temperatures.

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

Display	Cable	Item 129
LED1	CAB40	LED1 (1)
LED5	CAB34	LED5 (0)
LED8	CAB34	

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 air on temperature with the air on temperature setpoint. The computed setpoint is raised or lowered depending on whether the air on temperature is below or above the temperature setpoint. The computed air off setpoint cannot go more than 4°C below the air on setpoint.

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, 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 deenergised.

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 backups the defrost schedule as set up for real time defrost on items 51-56 is used. If network communication fails, the selected strategy method 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, ir if there is a fault at 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 "

Defrost Recovery
When the termination temperature or time is reached the controller enters defrost recovery. 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. 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 the 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. **NOTE** this feature was introduced in Oct 1996 and requires the JTL defrost scheduler and JTL network controller to support this function.

High Temperature Alarms
The air on temperature is monitored continually. The temperature is averaged over the period set on item 47. If the average temperature 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 can be cancelled or left enabled during defrost and defrost recovery using 127.

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 33% 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. 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.

Coldstore Door Functions
When the coldstore door is opened, refrigeration is stopped by shutting the liquid solenoid valve and stopping the evaporator fans. If the door remains open for a time longer than the value set on item 64 then refrigeration is restarted. If the door remains open for a time longer than set on item 33 then an alarm is given. The door open alarm can be set to be critical using item 126.

Coldroom Isolation
The controller can be isolated for standby operations using item 67. When isolated, all output relays are de-energised and the alarms disabled.

Switch Controlled Shutdown
The controller can be shutdown for servicing purposes using an external switch. This feature is enabled by item 138.

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				LCIS
Item	Function	Range	Units	Bitswitch settings
1	Unit number	0.1 to 899.9		4321
30	Air on temperature setpoint	-30 to +25	°C	xxCC Frozen food
32	Overtemperature tolerance	0 to +20	°C	xxC0 Ice cream
33	Door open alarm delay	00:00 - 03:00	hr:mn	xx0C Chillers
36-39	Probe selections	0=off 1=on		xx00 Produce
47	Alarm averaging time	00:30 to 03:00	hr:mn	
48	Compressor starts/hour	unlimited /10/15/20		where
49	Refrigeration delay after defrost	00:00 to 00:10	hr:mn	C = closed
50	Defrost termination temp (air off)	0 to +20	°C	0 = open
51-56	Defrost schedule	00:01 - 23:59	hr:mn	x = don't care
57	Defrost termination time	00:05 to 00:59	hr:mn	
58	Defrost initiation temp (suction)	-10 to +30	°C	closed = dot visible
59	Drain down time	00:00 - 00:20	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		
64	Door open refrigeration delay	00:00 - 00:30	hr:mn	
65	Invert defrost input	0=no 1=yes		
66	Invert plant input	Alarms on: 0=input 1=no input		
67	Isolate controller	0=run 1=isolated		
69	Number of defrosts expected	0 to 6		
75	Defrost control mode	0=termination 1=control		
76	Suction valve selection	0=Auxiliary heater 1=Suction valve		
107	Defrost strategy	0=none 1=Suction 2=Network(learned backup) 3=Time 4=Contact 7=Network(realtime backup)		
108	Fan control	1=run always 2=off during defrost		
109	Fan delay after defrost	00:00 to 00:10	hr:mn	
122	Temperature display choice	0=celsius 1=fahrenheit		
126	Door alarms critical	0=non critical 1=critical		
127	High temperature alarm inhibit	0=always enabled 1=inhibited during defrost		
128	Select door functions	0=off 1=on		
129	Select display type	0=LED5 1=LED1		
133	Enable plant to override temp control	0=disabled 1=enabled		
134	Enable plant to cut off refrigeration	0=disabled 1=enabled		
144	Defrost termination method	1=Evaporator 2= Air off 3=Termination 4=Time only		
145	Minimum defrost time	00:00 - 00:30	hr:mn	
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		
175	Pressure transducer type	1=18 bar (mk1 board) 2=18 bar (mk 2 board) 3=7 bar (mk2 board)		
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
21	Air on temperature	70	Operating mode
22	Air off temperature	71	Input states
23	Evaporator temperature	72	Defrost output state
24	Suction line temperature	73	Liquid valve output state
28	Effective air off setpoint	74	Auxiliary heater and fan output states
34	Time door has been open	77	Forced defrost
35	Time door open in last 24 hours	78	Inhibit defrost
40	Duration of last defrost	79	Forced refrigeration
41	Time since end of last defrost	141	Termination sensor temperature
42	Duration of this defrost	203	Associated plant suction line
46	Network defrost command	240	Liquid valve open %
63	Network shutdown and fans only command states	241	Average liquid valve open %
		261-272	Learned defrost schedule
PULSED EXPANSION VALVE FUNCTIONS			
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	For PEV opening %	190	Modifier output %
168	PEV vavle opening %		

OUTPUT STATE DIAGRAM FOR JTL CONTROLLER

LCIS

		OUTPUT & FUNCTION					
		RL1	**RL2**	**RL3**	**RL4**		**RL5**
		PAN HEATER or SUCTION VALVE (N/O)	**FANS (N/O)** can be set to run always [108]	**LIQUID SOLENOID VALVE (N/O)** See Note 1	**DEFROST (C/O)** ITEM 75 CONTROL	**DEFROST (C/O)** ITEM 75 TERMINATION	**ELECTRONIC EXPANSION VALVE (N/O)** Solid state output See Note 1
NORMAL REFRIGERATION CYCLE	**REFRIGERATION**	OFF	ON (See note 2)	CYCLES ON AIR OFF TEMPERATURE (See note 2)	OFF	ON ABOVE TERMINATION TEMP	CYCLES ON AIR OFF TEMPERATURE (See note 2)
	PUMP DOWN Adjustable time [61]	OFF	OFF	OFF	OFF (from version 0.00.7)	OFF	OFF
	DEFROST Time/temp terminated [57]/[50]	ON	OFF	OFF	CYCLES ON TERMINATION TEMP (from version 0.00.8)	OFF	OFF
	DRAIN DOWN Adjustable time [59]	ON	OFF	OFF	OFF	ON	OFF
	LIQUID HOLD OFF Adjustable time [49]	OFF	OFF	OFF	OFF	ON	OFF
	RECOVERY TIME Time/temp terminated	OFF	CYCLES ON EVAPORATOR TEMPERATURE	CYCLES ON AIR OFF TEMPERATURE	OFF	ON	CYCLES ON AIR OFF TEMPERATURE
	REFRIGERATION	OFF	ON	CYCLES ON AIR OFF TEMPERATURE	OFF	ON ABOVE TERMINATION TEMP	CYCLES ON AIR OFF TEMPERATURE
PLANT FAULT		OFF	OFF	OFF	OFF	ON	OFF
ISOLATED		OFF	OFF	OFF	OFF	OFF	OFF
UNIT SHUTDOWN		OFF	OFF	OFF	OFF	OFF	OFF
FORCED DEFROST		ON	OFF	OFF	ON	OFF	OFF
FORCED REFRIGERATION		OFF	ON	ON	OFF	ON	CYCLES ON AIR OFF TEMPERATURE
INHIBIT DEFROST		OFF	ON	CYCLES ON AIR OFF TEMPERATURE	OFF	ON	CYCLES ON AIR OFF TEMPERATURE

NOTE 1: EITHER RL3 OR RL5 IS OPERATED DEPENDING ON SETTING [160]
NOTE 2: REFRIGERATION AND FANS CAN BE TURNED OFF WHEN DOOR OPENS (ITEM 64)
NOTE 3: [NN] REPRESENTS ITEM NN ON THE JTL MAINTENANCE UNIT

Relay Output Rating
RL1-4 5A resistive RL5 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. 01741	Software Variations Doc No. 01742	Wiring Diagrams Doc No. 01658 Doc No. 01734
Evaporator Manual Doc No. 01923	Installation Requirements Doc No. 01662	

01995-LCIS.wpd Issue 9 Sept 2016 Doc No. 01995
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