

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 **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 (CON 2)			
I1 C	INPUT 1	(LINE) (NEUTRAL)	SHUTDOWN
I2 C	INPUT 2	(LINE) (NEUTRAL)	MAN TRAPPED OR DOOR OPEN

Temperatures and Pressure (CON 4)			
1, 2	AIR ON TEMP		
3, 4	AIR OFF TEMP		
5, 6	SUCTION LINE		
7, 8	EVAPORATOR		
9, 10	TERMINATION		
11, 12	UNUSED		
13, 14	SUCTION PRESSURE ! +		

Outputs

Outputs (CON 3)			
1 NO 1 LN	OUTPUT 1	(N/O LOAD) (LINE)	PAN HEATER
2 NO 2 LN	OUTPUT 2	(N/O LOAD) (LINE)	FANS
3 NO 3 LN	OUTPUT 3	(N/O LOAD) (LINE)	SUCTION 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

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**

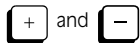
To set item 31 to &20.0 press:

ITEM **3** **1** **ENTER** **SET** **-** **2** **0** **0** **ENTER**

To correct errors press:



To select next or previous items press:



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. From v0.01.1 this controller has virtual bitswitches which replace the physical bitswitches. The virtual bitswitches are set using item 966. 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 displays the coldroom temperature. The temperature can be displayed in Celsius or Fahrenheit as selected by item 122.

The LACI controller drives the JTL LCD13 display using a CAB75 cable. Various cable lengths are available.

Refrigerant Type

This controller will operate for Carbon Dioxide (R744) and various HFC refrigerants as well as HCFC type R408A. The refrigerant choice is made on item 157. CO₂ (R744) operation is only allowed for frozen food applications and requires the pressure transducer to be selected as -1 to 34 bar (item 175 set to 3). Other refrigerants require the transducer to be -1 to 7 bar (item 175 set to 4).

Control Strategy

The controller can control to the coldroom temperature or the air off temperature selected using item 275.

The temperature is controlled to the setpoint by controlling pulsed expansion valve.

The computed air off temperature setpoint (item 28) is calculated by comparing the displayed temperature with the coldroom temperature setpoint. The computed setpoint is raised or lowered depending on whether the coldroom temperature is below or above the coldroom temperature setpoint. The computed air off setpoint cannot go below the value set on item 31.

Superheat Control

The superheat control can be set to operate in 3 ways using item 188.

a) SUCCEEDS. In SUCCEEDS strategy the air temperature is controlled and the superheat allowed to float.

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

b) SUCCEEDS with limit. The superheat is allowed to float to the maximum set on item 189. When the case temperature is achieved the PEV shut. It is reopened again with a deadband adjustment on item 140.

c) Fixed. The superheat is controlled using PI control on the superheat temperature. When the case temperature is achieved the PEV is shut. It is reopened again with a deadband adjustment on item 140.

In all cases 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.

When item 188 is set on the superheat is controlled to a maximum when the case control temperature is being achieved. If the case control temperature error is negative and the superheat is greater than maximum set on item 189 the expansion valve is closed.

Pressure Transducer Failure Strategies

There are 3 strategies (set on item 177):
 1. Open circuit. Automatic switch to 2 temperature control and raise transducer fault alarm.
 2. Auto zero adjust.
 3. Network zero range check against average plant pressure, high pressure gives automatic switch to 2 temperature control. Outside range raise transducer fault alarm.

All 3 strategies are subject to a 5 minute delay timer. The delay is symmetrical i.e. the condition must be present/clear for 5 minutes to set/clear alarm.

7 bar transducers are alarmed at +/- 5 psi and auto zero range limited to +/- 7.5 psi. 34 bar transducers are alarmed at +/- 15 psi and auto zero range limited to +/- 22.5 psi. Auto switch to 2 temperature control is on upper limit of range i.e. +75 and +22.5 psi.

External shutdown facilities

If item 273 is set on then when input 1 is energized the expansion valve is closed. This override input is to prevent "flooding back" in the event of plant failure.

There is also a shutdown feature which can be enabled using item 174. High suction pressure on the transducer input can also shut the pulsed expansion valve.

Defrost Initiation Strategies

The defrost strategy can be initiated in 2 fundamental ways using item 107. Defrost initiation can be by real time clock, or by command on the JTL communications network.

When real time defrost is selected items 51-56 set the start of defrost. The schedule can be set for 12 or 24 hour sequence (item 160). Each timed defrost can be programmed for electric or off cycle using items 351-356.

Network initiated defrost can be divided into 3 groups; PREDICT, coordinated and scheduled.

When the controller is set for SUCCEEDS control it uses the PREDICT 1 method which monitors the PEV override operation.

When set for fixed superheat control it uses the PREDICT 3 method which detects the volatility of the superheat.

PREDICT defrost requires that a JTL PREDICT defrost coordinator unit is available on the network. This unit receives requests from the PREDICT controllers and coordinates these requests so that the defrosts are organised ensuring the electrical and refrigeration requirements are met. When the controller requests a defrost the PREDICT coordinator will send out a defrost command at a suitable time.

If there is no PREDICT co-ordinator on the network the controller reverts to co-ordinated defrost. If the controller is set for 2 temperature control the defrost strategy reverts to co-ordinated defrost.

Coordinated timed defrost requires a timed defrost or defrost coordinator to be present in the network. When coordinated timed request is selected then the controller requests a defrost as defined by the number of defrosts a day as set on item 69. The defrost coordinator coordinates the defrost as required. The backup strategy can be chosen to fall to learned defrost schedule or real time backup.

Backup Defrost Initiation Strategies

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 if there is a fault at the defrost scheduler.

Defrost

The defrost output relay is energised during the defrost period.

The PEV is closed during defrost. The auxiliary output can be selected for fan or heater control. During defrost the fans can be stopped and the auxiliary heater energised.

A pump down delay can be applied (item 61) before the defrost/output and heater are energised. During pump down the PEV is closed.

The display shows "dEF"

Defrost Termination

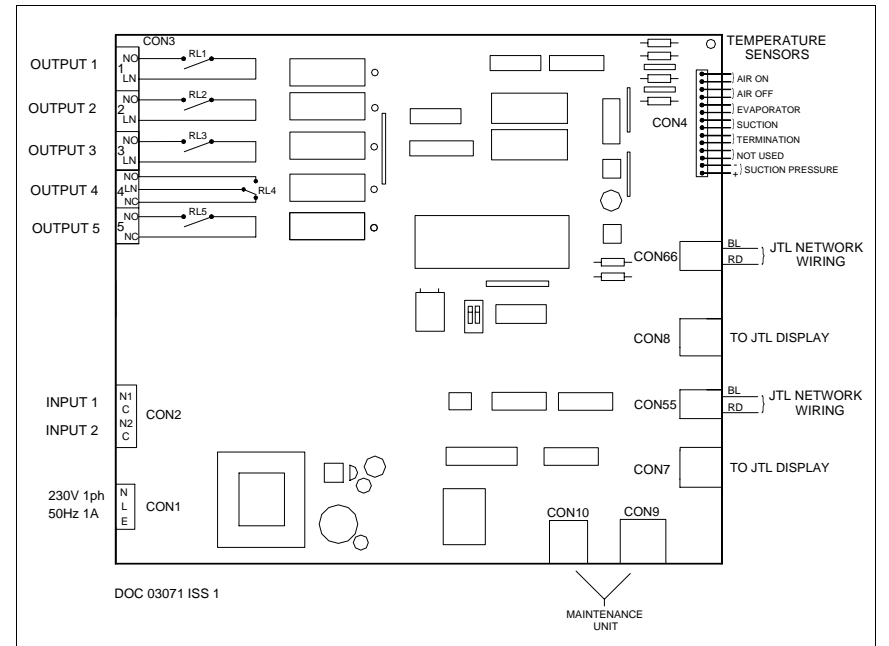
The controller stays in defrost at least until the minimum defrost time, on item 145, is exceeded. If the termination temperature is reached before the minimum defrost time then the defrost heater is cycled.

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.

A time delay can be applied (item 49) after defrost before the PEV 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.



The display shows "dEF".

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.

Fan Control

The fans can be controlled in various ways.

If item 108 is set to "fans off during defrost" or "off during electric defrost" then 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. If item 109 is set to a time then the fans are held off until the time delay has occurred.

High Temperature Alarms

The coldroom 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 are cancelled during defrost and defrost recovery.

The temperature tolerance is set on item 32. Setting the tolerance to 0.0°C disables the alarm.

Excessive Superheat Alarms

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 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.

INPUT 2 CONFIGURATION

Input 2 can be used for the "man trapped" alarm OR coldroom door state.

Man Trapped Alarm

A man trapped alarm input is available for alarm indication and on the JTL network. The alarm is activated when there is no input.

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.

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 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				LACI
	item	Function	Range	Units
TEMPS & ALARMS	36-39	Sensor selections	0=off 1=on	
	147	Termination sensor selection	0=off 1=on	
	32	Overtemperature tolerance	0 to +20	°C
	47	Alarm averaging time	00:30 to 03:00	hr:mn
CONTROL	275	Control temperature	0=Air off 1=cabinet temp	
	140	Temperature control deadband	0.4 to 3.0	°C
	30	Temperature setpoint	-30 to +25	°C
	48	Compressor starts/hour	unlimited /10/15/20	
	106	Auxiliary output selection	0=off 1=Fan 2=Heater 3=both	
	67	Isolate coldroom	0=normal 1=isolated	
PULSED EXPANSION VALVE FUNCTIONS	157	Refrigerant type	1 - 9 (R type shown on MU display)	
	158	Pressure transducers zero offset	-7 to +7	psi
	161	Control strategy	1=2 temperature 2=pressure	
	188	Superheat control strategy	0=SUCEEDS 1=SUCEEDS with limit 2=fixed	
	189	Maximum superheat	6.0 - 12.0	
	162	Minimum superheat (pressure)	0 - 10	°C
	186	Minimum superheat (2 temperature)	0 - 5	°C
	163	Maximum valve opening (pressure)	10 - 100	%
	187	Minimum valve opening (2 temperature)	5 - 50	%
	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	3= -1 to 34 bar 4= -1 to 7 bar	
	177	Auto zero pressure enable	0=disabled 1=enabled	
179	Pressure display choice	1=psi 2=bar 3=kPa		
273	PEV override input	0=disable 1=enable		
DEFROST INITIATION	107	Defrost strategy	0=none 2=Network (learned backup)3=Time 5=PREDICT 7=Network (real time backup) 8=Coordinated (learned) 9=Coordinated (real time)	
	69	Number of defrosts expected or required	0 to 12	hr:mn
	61	Pump down time	00:00 - 00:10	hr:mn
	51-56	Defrost schedule	00:01 - 23:59	
	351-356	Defrost type for times 51-56	0=Electric 1=Off cycle	
	60	Defrost schedule 12/24 hour clock	0=24hr 1=12hr	
	211	Evaporator group	0=none 1=Lt 2=Ht 3=Satellite	
	210	Electrical supply distribution panel no	0 to 15=panel no	
	213	Electrical supply circuit	0=none 1-15=circuit	hours
	214	Defrost method	0=brown phase 1=black phase 2=grey phase 3=3 phase 4=2 pipe gas 5=3 pipe gas 6=off cycle	hours
	223	Defrost requirement priority	1 to 8	%
	225	PREDICT Minimum time between defrosts	2 to 8	
	226	PREDICT Maximum time between defrosts	6 to 72	
242	PREDICT override initiation	0 - 100		
DEFROST TERMINATION	144	Defrost termination method	1=Evaporator 2= Air off 3=Termination 4=Time only	°C
	50	Defrost termination temp	0 to +20	hr:mn
	145	Minimum defrost time	00:00 - 00:30	hr:mn
	57	Defrost termination time	00:05 to 00:59	hr:mn
	59	Drain down time	00:00 to 00:10	hr:mn
	49	Refrigeration delay after defrost	00:00 to 00:10	hr:mn
FAN CONTROL	108	Fan control	1=run always 2=off during defrost 3=off during electric defrost	°C
	146	Temperature to turn fans off during defrost	-12 to +20	hr:mn
	109	Fan delay after defrost	00:00 - 00:10	
DOOR	128	Select door functions	0=off 1=on	
	126	Door alarms critical	0=not critical 1=critical	
	33	Door open alarm delay	00:00 to 00:30	hr:mn
	64	Door open refrigeration delay	00:00 to 00:30	hr:mn
Jnet FUNCTIONS	1	Unit number	0.1 - 899.8	
	62	Jnet network shutdown selection	0=disabled 1=enabled	
	133	Enable plant to override temp control	0=off 1=on	
	134	Enable plant to cut off refrigeration	0=disabled 1=enabled	
	200	Exclude from suction optimisation	0=include 1=exclude	
	18	Daylight saving operation	0=standard time 1=daylight saving time	
DISPLAY	122	Temperature display choice	0=Celsius 1=Fahrenheit	
INPUTS	138	Input 2 function	3=Man trapped 4=door open	

Bitswitch settings 21, 0(CC) Frozen food, 1(CO) Ice cream, 2(OC) Chillers, 3(OO) Produce, where C = closed, O = open, closed = dot visible (0to3 is the virtual bitswitch setting on item 966)

OTHER USEFUL ITEMS							
Item	Function	Item	Function	Item	Function	Item	Function
20	TEMPERATURES Coldroom temperature	154	PULSED EXPANSION VALVE FUNCTIONS	70	MODE INPUTS & OUTPUTS	40	DEFROST
21	Air on temperature	155	Force pressure average to current reading	71	Operating mode	41	Duration of last defrost
22	Air off temperature	156	Suction pressure	72	Plant fault input	42	Time since end of last defrost
23	Evaporator temperature	159	Superheat	74	Defrost output state	46	Duration of this defrost
24	Suction line temperature	166	Auto zero offset	139	Auxiliary output state	77	Communications defrost command
141	Termination sensor temperature	168	Force PEV opening (%)	63	Man trapped input state	78	Forced defrost
28	CONTROL Effective air off setpoint	181	PEV valve opening (%)	203	Jnet NETWORK FUNCTIONS	79	Inhibit defrost
240	Liquid valve open %	182	PEV status		Network shutdown and fans only command states	261-	Forced refrigeration
241	Average liquid valve open %	190	Time since last override (hr:mn)		Associated plant suction line	272	Learned defrost schedule
			Duration of last override (sec)			219	Defrost arrangement from network
			Modifier output (%)			221	Forced defrost requirement
						222	Enable forced defrost requirement
						243	PREDICT override average (%)

OUTPUT STATE DIAGRAM FOR JTL CONTROLLER					LACI	
MODE OF OPERATION	OUTPUT & FUNCTION (See note 5)					
	RL1	RL2	RL3	RL4	RL5	
	PAN HEATER	FAN (N/O)	SUCTION VALVE (N/O)	DEFROST (C/O)	PULSED EXPANSION VALVE (N/O) Solid state output	
N O R M A L R E F R I G E R A T I O N C Y C L E	REFRIGERATION	OFF	ON	ON	OFF	CYCLES ON AIR OFF TEMPERATURE
	PUMP DOWN Adjustable time [61]	OFF	ON	ON	OFF	OFF
	DEFROST Time/temp terminated [57]/[50]	ON	OFF (See Note 3)	OFF	Cycles on termination temp	OFF
	DRAIN DOWN Adjustable time [59]	ON	OFF (See Note 3)	OFF	OFF	OFF
	LIQUID HOLD OFF Adjustable time [49]	OFF	OFF (See Note 3)	ON	OFF	OFF
	RECOVERY TIME Time/temp terminated	OFF	TEMPERATURE OR TIME CONTROLLED (See Note 2)	ON	OFF	CYCLES ON AIR OFF TEMPERATURE
	REFRIGERATION	OFF	ON	ON	OFF	CYCLES ON AIR OFF TEMPERATURE
PLANT FAULT	OFF	OFF	ON	OFF	OFF	
ISOLATED	OFF	OFF	OFF	OFF	OFF	
UNIT SHUTDOWN	OFF	OFF	OFF	OFF	OFF	
FANS ONLY SHUTDOWN	OFF	ON	OFF	OFF	OFF	
FORCED DEFROST	ON	ON	OFF	ON	OFF	
FORCED REFRIGERATION	OFF	ON	ON	OFF	CYCLES ON AIR OFF TEMPERATURE	
INHIBIT DEFROST	OFF	ON	ON	OFF	CYCLES ON AIR OFF TEMPERATURE	


NOTE 2: FANS OFF UNTIL TIME SET ON ITEM 109 REACHED. IF 109 SET TOO 00:00 FANS CYCLE ON EVAPORATOR TEMPERATURE
NOTE 3: FANS CAN BE SET TO RUN DURING DEFROST, DRAIN DOWN AND LIQUID HOLD OFF USING ITEM 108.

Relay Output Rating

5A resistive.

Supply Requirements

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

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

SUCCEEDS® is the patented JTL algorithm for control of liquid injection into an evaporator using electronic expansion valves.

PREDICT® is the patented JTL pattern recognition algorithm for providing defrost on demand for the cabinets on a system.

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. 03405	Firmware Variations Doc No. 03407	Connections Diagram Doc No. 03490
Evaporator Manual Doc No. 01923	Installation Requirements Doc No. 03036	Schematic Diagram Doc No. 03489