

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 (CON 2) | | | |
|-----------------------------------|------------------------------|---------------------|----------------------|
| I1 C | INPUT 1 | (LINE) (NEUTRAL) | DEFROST ON |
| I2 C | INPUT 2 | (LINE) (NEUTRAL) | LIGHTING OVERRIDE |
| Temperatures and Pressure (CON 4) | | | |
| 1, 2 | AIR ON TEMP | | |
| 3, 4 | AIR OFF TEMP | | |
| 5, 6 | SUCTION LINE | | |
| 7, 8 | EVAPORATOR | | |
| 9, 10 | ENERGY SAVING OR TERMINATION | | |
| 11, 12 | UNUSED | | |
| 13, 14 | SUCTION PRESSURE - + | | |

Outputs

| Outputs (CON 3) | | | |
|----------------------|----------|------------------------------------|---|
| 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) | PULSED EXPANSION VALVE or LIQUID SOLENOID 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:

To set item 31 to -20.0 press:

To correct errors press:



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 LAPE controller will drive the following JTL displays when used with the CAB55 extension cable.

| Display | Cable | Switch |
|---------|-------|------------|
| LCD8 | CAB55 | None |
| LCD9 | CAB55 | 3 position |
| LCD11 | CAB55 | 4 position |

The LCD9 and LCD11 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 LCD9 if only one additional function is selected, then it is available in either of the extra 2 positions.

The CAB55 cable is available in various lengths.

Control Strategy

The air off temperature is controlled to a computed setpoint shown on item 28, by controlling a liquid line solenoid valve with a mechanical expansion valve.

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 LAPE 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.

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.

For liquid solenoid control, if the air off temperature falls below the computed setpoint the liquid valve is closed. There is an adjustable deadband set using item 140.

Defrost Initiation Strategies

The defrost strategy can be initiated in 4 fundamental 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.

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

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 the backup strategy is invoked the controller reverts to real time schedule.

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.

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

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

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 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.

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.

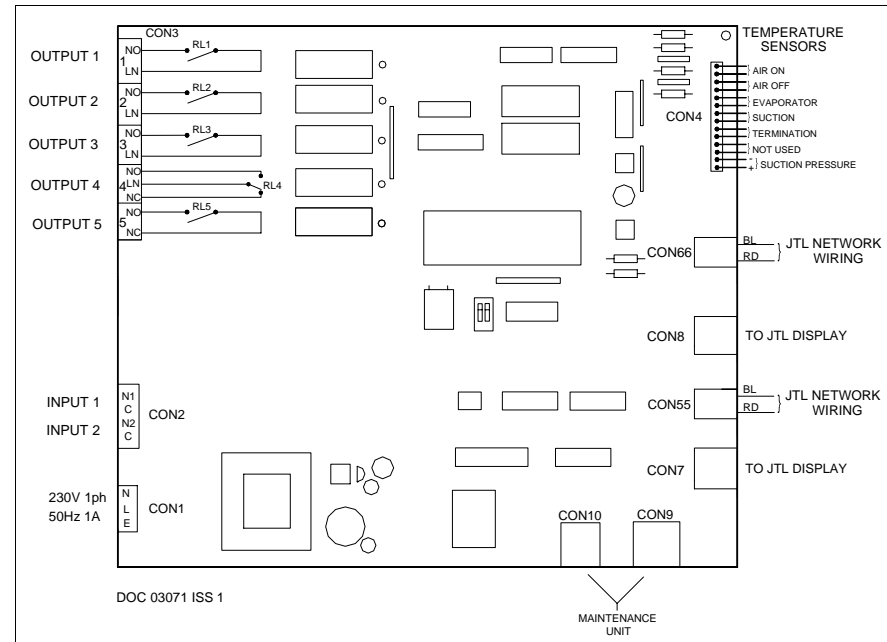
Defrost Recovery

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.

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.

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" 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.

If item 108 is set to "fan control during defrost"; the fans are turned off during defrost when the evaporating temperature goes above the setting on item 146. After defrost the fans are turned on when the evaporating temperature falls below the setting on item 150 or the time delay on item 109, if it is not set to 00:00.

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

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 switched off if either fans only or shutdown are selected.

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.

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 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 | | | | LAPE |
|----------------------------------|-----------------------------------|---|---|-------|
| | item | Function | Range | Units |
| TEMPS & ALARMS | 33 | Cabinet temperature ratio | 20 to 80 | hr:mn |
| | 408 | Air off calculation method | 1=Lowest 2=Middle 3=Highest 4=Average 5=Average lowest 2 6=Average highest 2 | |
| | 36-39 | Sensor selections | 0=off 1=on | °C |
| | 147 | Termination sensor selection | 0=off 1=on | |
| | 32 | Cabinet overtemperature tolerance | 0 to +20 | |
| | 34 | Air off over temperature tolerance | 0 to +30 | |
| | 47 | Alarm averaging time | 00:30 to 03:00 | |
| CONTROL | 123 | Enable 2nd setpoint | 0=disabled 1=enabled | °C |
| | 124 | Primary cabinet temperature setpoint | -30 to +10 | |
| | 125 | Secondary cabinet temperature setpoint | -30 to +10 | °C |
| | 31 | Air off temperature setpoint | -39 to +5 | °C |
| | 140 | Temperature control deadband | 0.4 to 3.0 | °C |
| | 48 | Compressor starts/hour | unlimited /10/15/20 | |
| | 75 | Defrost control mode | 0=termination 1=control | |
| 106 | Auxiliary output selection | 0=off 1=Fan 2=Heater | | |
| PULSED EXPANSION VALVE FUNCTIONS | 157 | Refrigerant type | 0 - 6 (R type shown on MU display) | psi |
| | 158 | Pressure transducers zero offset | -7 to +7 | |
| | 160 | Control valve | 0=Liquid solenoid 1=PEV | °C |
| | 161 | Control strategy | 1=2 temperature 2=pressure | |
| | 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 | |
| 177 | Auto zero pressure enable | 0=disabled 1=enabled | | |
| 179 | Pressure display choice | 1=psi 2=bar 3=kPa | | |
| DEFROST INITIATION | 107 | Defrost strategy | 0=none 1=Suction 2=Network (learned backup)3=Time 4=Contact 5=PREDICT 7=Network (real time backup) 8=Coordinated (learned) 9=Coordinated (real time) | hr:mn |
| | 69 | Number of defrosts expected or required | 0 to 12 | |
| | 61 | Pump down time | 00:00 - 00:10 | hr:mn |
| | 51-56 | Defrost schedule | 00:01 - 23:59 | hr:mn |
| | 60 | Defrost schedule 12/24 hour clock | 0=24hr 1=12hr | |
| | 58 | Defrost initiation temp (suction) | -5 to +20 | °C |
| | 65 | Invert defrost input | 0=no 1=yes | |
| | 211 | Evaporator group | 0=none 1=Lt 2=Ht 3=Satellite | |
| | 213 | Defrost heater circuit | 0=none 1-7=circuit | |
| | 214 | Defrost method | 0=red phase 1=yellow phase 2=blue phase 3=3 phase 4=2 pipe gas 5=3 pipe gas 6=off cycle | |
| | 223 | Defrost requirement priority | 1 to 8 | |
| | 225 | PREDICT Minimum time between defrosts | 2 to 8 | hours |
| | 226 | PREDICT Maximum time between defrosts | 6 to 72 | hours |
| 227 | PREDICT Sample discard list | 0 to 3 | | |
| 228 | PREDICT volatility setpoint | 2 to 12 | | |
| DEFROST TERMINATION | 144 | Defrost termination method | 1=Evaporator 2= Air off 3=Termination 4=Time only | °C |
| | 50 | Defrost termination temp | 0 to +20 | |
| | 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=fan controlled during defrost | °C |
| | 146 | Temperature to turn fans off during defrost | -12 to +20 | |
| | 109 | Fan delay after defrost | 00:00 - 00:10 | hr:mn |
| | 150 | Temperature to turn fans on after defrost | -20 to +5 | °C |
| | 130 | Fan control sensor selection | 0=disabled 1=enabled | |
| 132 | Fan control temperature setpoint | -30 to +8 | °C | |
| LIGHTING CONTROL | 110 | Jnet lighting control selection | 0=disabled 1=enabled | |
| | 118 | Lighting contractor selection | 0=n.o 1=n.c | |
| | 119 | Enable lights during shutdown | 0=disabled 1=enabled | |
| 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 | |
| 18 | Daylight saving operation | 0=standard time 1=daylight saving time | | |
| DISPLAY | 122 | Temperature display choice | 0=celsius 1=fahrenheit | |
| | 136 | Enable fans only mode from display | 0=disabled 1=enabled | |
| | 138 | Enable display controlled shutdown | 0=Off 1=On | |

Bitswitch settings 21, CC Frozen food, CO Ice cream, OC Chillers, OO Produce, where C = closed, O = open, closed = dot visible

| OTHER USEFUL ITEMS | | | | | | | |
|--------------------|--------------------------------|------|---|------|----------------------------------|---------|---|
| Item | Function | Item | Function | Item | Function | Item | Function |
| 20 | TEMPERATURES | 154 | PULSED EXPANSION VALVE FUNCTIONS | 70 | MODE INPUTS & OUTPUTS | 40 | DEFROST |
| 21 | Cabinet temperature | 155 | Force pressure average to current reading | 71 | Operating mode | 41 | Duration of last defrost |
| 22 | Air on temperature | 156 | Suction pressure | 72 | Defrost input state | 42 | Time since end of last defrost |
| 23 | Air off temperature | 159 | Superheat | 73 | Defrost output state | 46 | Duration of this defrost |
| 24 | Evaporator temperature | 166 | Auto zero offset | 74 | Liquid valve output state | 47 | Communications defrost command |
| 401 | Suction line temperature | 168 | Force PEV opening (%) | 77 | Auxiliary output state | 77 | Forced defrost |
| 402 | Air off 1 temperature | 169 | PEV valve opening (%) | 111 | LIGHTING | 78 | Inhibit defrost |
| 403 | Air off 2 temperature | 181 | PEV status | 112 | Communications lighting | 79 | Forced refrigeration |
| 131 | Air off 3 temperature | 182 | Time since last override (hr:mn) | 113 | command | 261-272 | Learned defrost schedule |
| 141 | Energy saving temperature | 190 | Duration of last override (sec) | 114 | Lighting override input state | 219 | Defrost arrangement from network |
| 30 | Termination sensor temperature | | Modifier output (%) | 115 | Lighting output state | 221 | Forced defrost requirement |
| 28 | CONTROL | | | | 114 | 222 | Enable forced defrost requirement |
| 240 | Cabinet temperature setpoint | | | | 115 | 115 | Jnet NETWORK FUNCTIONS |
| 241 | Effective air off setpoint | | | | | 63 | Network shutdown and fans only command states |
| 240 | Liquid valve open % | | | | | 203 | Associated plant suction line |
| 241 | Average liquid valve open % | | | | | | |

| OUTPUT STATE DIAGRAM FOR JTL CONTROLLER | | | | | | LAPE | |
|--|---|-----|--|---------------|---|--|-------------------------------|
| 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 | | | |
| 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 (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 | PEV 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 3: CAN CYCLE ON ENERGY SAVING TEMPERATURE (SELECTED BY ITEM 130)
NOTE 6: FANS OFF UNTIL TIME SET ON ITEM 109 REACHED.
IF 109 SET TO 00:00 FANS CYCLE ON EVAPORATOR TEMPERATURE

NOTE 2: CAN BE SET TO OFF USING ITEM 106
NOTE 5: RL1 IS FOR LIGHTING CONTROL
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. 03050 | Firmware Variations Doc No. 03051 | Connections Diagram Doc No. 03049 |
| Evaporator Manual Doc No. 01923 | Installation Requirements Doc No. 03036 | Schematic Diagram Doc No. 03048 |