

Resource
Data Management

ML Twin Compressor Controller

Commissioning/User Guide
Revision 2.3g



PR0123-TWI

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Please ensure all power is switched off before installing or maintaining this product.

Introduction

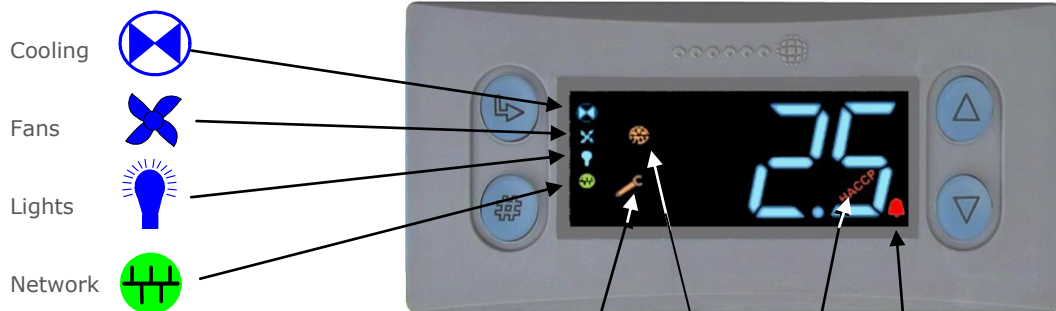
The ML Twin Compressor Controller is a dual stage thermostat with adjustable parameters, incorporating a defrost scheduling timer, lights control, fan control, trim heater control (with energy saving feature by pulsing trim heater) and an alarm handler. The controller can be networked back to an RDM Data Manager, see Network Configuration

The main features are: -

- Display with decimal or whole numbers
- Dual stage thermostat using on/off relays
- Probe 1: Air On Probe
- Probe 2: Air Off Probe
- Probe 3: Logging Probe or Defrost Probe or Plant Fault
- Probe 4: Logging Probe or Defrost Probe or Plant Fault
- Programmable parameters
- Defrost scheduler (up to 8/day)
- Manual defrost (from the display buttons)
- Network Defrost schedule option
- Fan control relay
- High volume Alarm buzzer Installation (Can be switched off) *Please see note [Alarm Sounder](#)
- RS232 output for IP Network connection
- Automatic compressor duty rotation
- Network Lights timer function
- Trim Heater control relay
- Remote Trim Heater control
- Remote network commands
- PT1000, NTC2K, NTC2K25 or 10K probes supported
- Case Off or Secondary Setpoint Offset option (linked to the lights schedule).
- Degrees C and Degrees F incorporated in one controller

Display

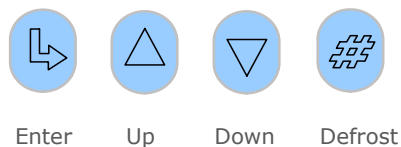
LED's:



Off No network attached
Flashing Attempting to Log on to network
Steady On-line

Service Defrost HACCP Alarm

Keys



Enter Up Down Defrost

Note: Function keys illuminate when pressed, illumination is turned off 20 seconds after the key is used. Press and hold the defrost button to force a manual defrost

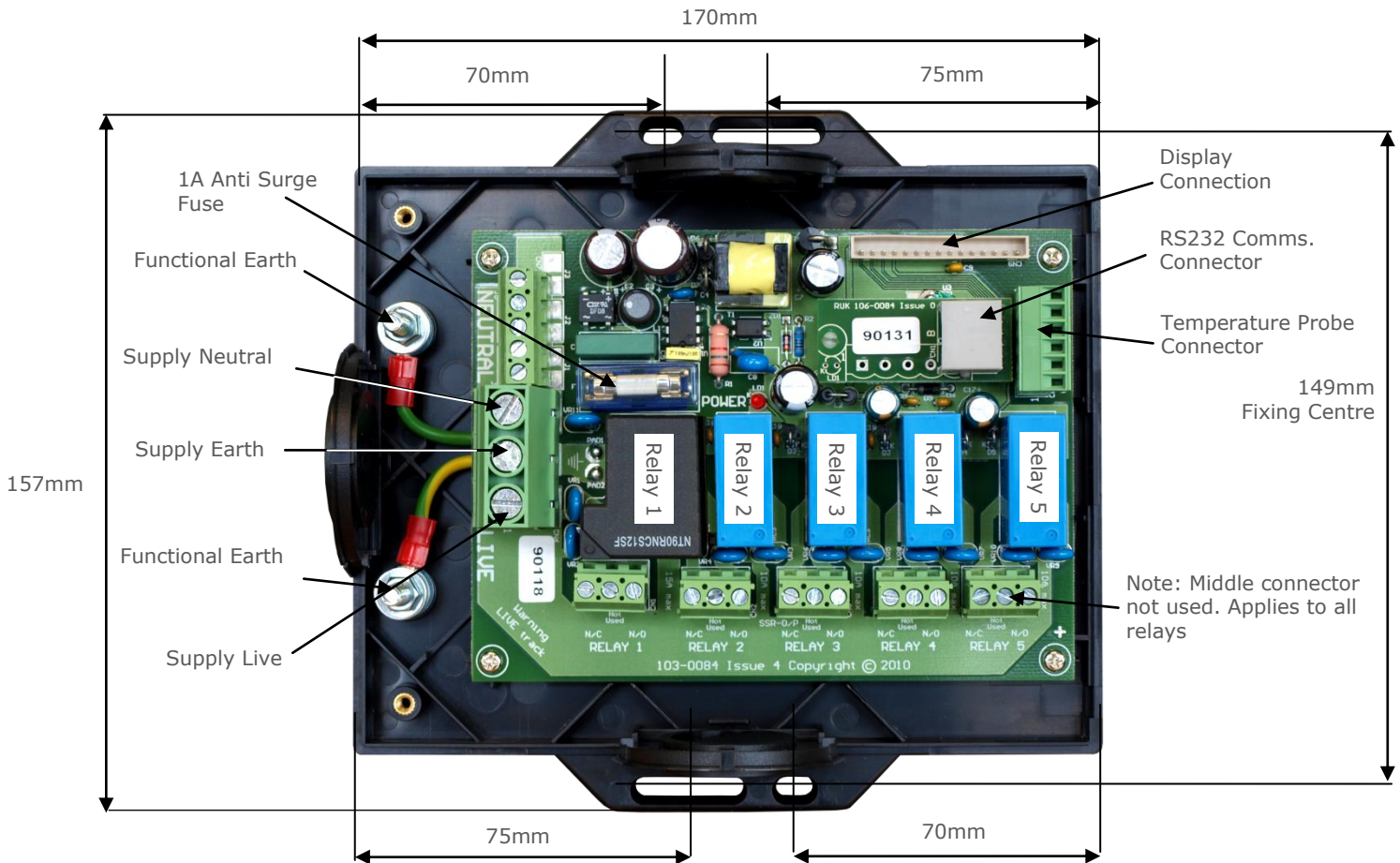


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Relay Modules

The ML controller is supplied in two parts, a panel mount display / control unit and a relay / power supply module in a black ABS enclosure. The two units are interconnected using the 0.75m lead supplied, the control unit derives its power from the relay module. All the terminals for power, control relays, networking and temperature probes are contained within the relay module as shown below. The ML controller can be used with a 230 Vac 50Hz or 110V 60Hz mains supply, the switched mains outputs for the relays are fed by the relay module so only one mains supply needs to be connected.

5 Relay module with RS232 connector (for connection to an IP Network)



Connections

- NEUTRALS: Supply Neutral connections
- LIVE: Supply Live connections
- N/C: Relay normally closed contact
- N/O: Relay normally open contact

Probe Connection Detail



- Probe Common
- Probe 4 Selectable
- Probe 3 Selectable
- Air Off
- Air On
- Probe Common



All relays will output the supply voltage
Note. Earth is a functional earth, not a safety earth



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Setting-up

Access to the controller settings can be achieved several ways,

- Through the display mounted buttons
- Direct access by PC into the RS232 comms port. This requires a software package available on the RDM website
- Through the RDM Data Manager.
- Across an IP network. (Current controller IP address required)

Viewing/Changing Menu Items

1. Press and hold **"ENT"** and **"DOWN"** for approximately 3 seconds the display will read **"EnT"**
2. Press and release **"ENT"**, the display will indicate **"IO"** *This is the inputs and outputs viewing option*
3. Use the **"UP"** or **"DOWN"** keys to cycle round the menu items, press enter at the desired item.

Example: pressing enter at "PARA" will allow you to view or change parameters

*Note. If menu item **"ESC"** is entered the controller will **escape** the set up and revert to normal operation*

Menu Items

IO	Displays the inputs and outputs	Inputs and Outputs
PARA	View and change parameters	Set view parameters
Unit	Change the Units (Probe Type)	Set view units
diSP	Change the display	Display
tyPE	View Controller type	Type
Id	Enter an ID (For IP-L Use)	Set view ID
Rtc	Real Time Clock	Real Time Clock
Net	Change the network settings	Network Configuration
hub	Selects Hub/Switch (Mercury or ML)	Hub/Switch Type
SoFt	View the software version	
OFSt	Probe Offsets	Probe Offset
rly1	Inverts the operation of Relay 1	Invert Relay 1
ESC	Escape back to normal operation	

Inputs and outputs

Selecting this menu option allows the user to view the inputs and outputs. Use the up/down button to select the desired input or output and then press "Enter". The value will be shown on the display. See [View IO](#)



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Parameter Tables

No.	Parameter	Range °C (°F)	Step	Units	Default
P-15	Lead Cut-In	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	3.0 (37.4)
P-16	Lead Diff	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	3.0 (5.4)
P-17	Lag Cut-In	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	6.0 (42.8)
P-18	Lag Diff	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	3.0 (5.4)
P-03	Control Weight	0 to 100	1	%	50
P-04	Probe 3 Type	0 = Off 1 = Monitor 2 = Monitor with Fault 3 = Monitor with Alarm 4 = Defrost term 5 = Plant N/O 6 = Plant N/C	1	-	0
P-05	Probe 4 Type	0 = Off 1 = Monitor 2 = Monitor with Fault 3 = Monitor with Alarm 4 = Defrost term 5 = Plant N/O 6 = Plant N/C	1	-	0
P-06	Relay 2 Function	0 = Fans 1 = Lights 2 = Trims 3 = Alarm 4 = SLV 5 = Trim Hub 6 = Comp	1	-	6
P-07	Relay 4 Function	0 = Fans 1 = Lights 2 = Trims 3 = Alarm 4 = SLV 5 = Trim Hub	1	-	1
P-08	Relay 5 Function	0 = Fans 1 = Lights 2 = Trims 3 = Alarm 4 = SLV 5 = Trim Hub	1	-	2
P-11	Trim level	0 to 100	1	%	100
P-12	Anti Short Cycle Time	00:00 to 99:00	01:00	mins:secs	01:00
P-14	Service Interval	0 to 128	1	KHrs	60
P-20	Alarm delay	00:00 to 99:00	01:00	mins:secs	20:00
P-21	Under Temp Alarm	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	-2.0 (28.4)
P-22	Over Temp Alarm	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	5.0 (41.0)
P-23	Monitor probe Alarm delay	00:00 to 99:00	01:00	mins:secs	20:00
P-24	Monitor probe Under Temp	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	-2.0 (28.4)
P-25	Monitor probe Over Temp	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	5.0 (41.0)
P-26	Alarm buzzer duration	00:00 to 61:00	01:00	mins:secs	00:00
P-40	Defrost Mode	0 = Local 1 = Remote	1	-	0
P-41	Defrost Start Time (Local mode)	00:00 to 23:59	00:01	hrs:min	01:00
P-42	Defrost number (Local mode)	0 to 8	1	-	6
P-43	No Defrost Time	0 to 180	1	Hrs	12
P-44	Defrost Termination Temperature	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	10.0 (50.0)
P-45	Defrost Time	00:00 to 99:00	01:00	mins:secs	20:00
P-46	Defrost Type	0 = Electric 1 = Gas 2 = Off Cycle	1	-	0
P-47	Drain Down Time	00:00 to 24:00	00:15	mins:secs	02:30



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No.	Parameter	Range °C (°F)	Step	Units	Default
P-48	Recovery Time	00:00 to 99:00	01:00	mins:secs	30:00
P-49	Fan Delay Time	00:00 to 99:00	01:00	mins:secs	15:00
P-50	Fans in Defrost	0 = Off 1 = On	1	-	0
P-51	Fan Delay Temperature	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	0.0 (32.0)
P-98	Lights Control	0 = Off 1 = Case Off 2 = Sec	1	-	0
P-81	Sec Offset	-60.0 (-76.0) to +60.0 (140.0)	0.1	°C (°F)	10.0 (50.0)
P-60	Lights Mode	0 = Local 1 = Remote 2 = Manual Off 3 = Manual On	1	-	0
P-61	Sunday On Time	00:00 to 23:59	00:01	hrs:min	08:00
P-62	Sunday Off Time	00:00 to 23:59	00:01	hrs:min	20:00
P-63	Monday On Time	00:00 to 23:59	00:01	hrs:min	08:00
P-64	Monday Off Time	00:00 to 23:59	00:01	hrs:min	20:00
P-65	Tuesday On Time	00:00 to 23:59	00:01	hrs:min	08:00
P-66	Tuesday Off Time	00:00 to 23:59	00:01	hrs:min	20:00
P-67	Wednesday On Time	00:00 to 23:59	00:01	hrs:min	08:00
P-68	Wednesday Off Time	00:00 to 23:59	00:01	hrs:min	20:00
P-69	Thursday On Time	00:00 to 23:59	00:01	hrs:min	08:00
P-70	Thursday Off Time	00:00 to 23:59	00:01	hrs:min	20:00
P-71	Friday On Time	00:00 to 23:59	00:01	hrs:min	08:00
P-72	Friday Off Time	00:00 to 23:59	00:01	hrs:min	20:00
P-73	Saturday On Time	00:00 to 23:59	00:01	hrs:min	08:00
P-74	Saturday Off Time	00:00 to 23:59	00:01	hrs:min	20:00
Dflt	Default Settings				



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Parameter Description

No.	Parameter	Description
P-15	Lead Cut-In	The value above which the controller starts the Lead Compressor.
P-16	Lead Diff	The value below the set point at which the controller stops the Lead Compressor.
P-17	Lag Cut-In	The value above which the controller starts the Lag Compressor.
P-18	Lag Diff	The value below the set point at which the controller stops the Lag Compressor.
P-03	Control Weight	Percentage of Probe 1 temperature that is used to calculate the control temp and display temp. The remaining percentage will be used on probe 2 temperature. Example, P-03 set to 30% Control temp = 30% Probe 1 + 70% Probe 2
P-04	Probe 3 Type	This parameter allows the user to change the function of input 3. See Monitor Probe
P-05	Probe 4 Type	This parameter allows the user to change the function of input 4. See Monitor Probe
P-06	Relay 2 Function	Sets the function of relay 2, defaults to Compressor
P-07	Relay 4 Function	Sets the function of relay 4, defaults to Lights
P-08	Relay 5 Function	Sets the function of relay 5, defaults to Trims
P-11	Trim level	Sets an On percentage level, of a 5-minute period, to pulse the trim heater relay off/on. Example: - P-11 set to 40% = 2 minutes On, 3 minutes Off
P-12	Anti Short Cycle Time	Time between compressor starts. See Anti-Short Cycle
P-14	Service Interval	Service interval time, set to 0 then back to reset. Brings on the service (Spanner) icon when active.
P-20	Alarm delay	Sets the OT/UT alarm delay
P-21	Under Temp Alarm	Under temperature Alarm set point.
P-22	Over Temp Alarm	Over temperature Alarm set point. See Over Temp Alarm
P-23	Monitor probe Alarm delay	Sets the monitor probe OT/UT alarm delay
P-24	Monitor probe Under Temp	Monitor probe Under temperature Alarm set point
P-25	Monitor probe Over Temp	Monitor probe Over temperature Alarm set point
P-26	Alarm buzzer duration	Sets the buzzer on duration when an alarm occurs. Set to 00:00 to not use the buzzer. *Please see note Alarm Sounder
P-40	Defrost Mode	Defrost mode – Local Mode : Controller schedules P-41 & P-42 Remote Mode : Front-end schedules.
P-41	Defrost Start Time (Local mode)	Defrost start time for local schedule
P-42	Defrost number (Local mode)	Number of defrosts per day (local mode)
P-43	No Defrost Time	Starts a defrost if no defrost command has been sent for this duration
P-44	Defrost Termination Temperature	Defrosts terminate when the Air Off/Defrost Probe temp reaches this value (See P-04 & P-05).
P-45	Defrost Time	Defrost duration, unless terminated by P-44
P-46	Defrost Type	Defrost type, (Gas type keeps the Comp relay/s active).
P-47	Drain Down Time	A period after defrost to allow the draining of any surplus water
P-48	Recovery Time	Recovery time after defrost, OT alarms are inhibited for this period
P-49	Fan Delay Time	Fans remain off until this time has elapsed or fan delay temperature is reached
P-50	Fans in Defrost	Fans on or off during defrost; if set to on, they go off at the drain down state and come on after the fan delay
P-51	Fan Delay Temperature	Fans stay off until this temperature is reached by the Air Off Probe or the fan delay time expires.
P-98	Lights Control	Off : Feature not used. Case Off : Places controller in to Case Off Mode when Lights timer is in the off state. Sec : Controller operates from a second offset (P-81) when the lights timer is in off period. See Case Off/Secondary Setpoint
P-81	Sec Offset	Secondary Offset associated to P-98. See Case Off/Secondary Setpoint
P-60	Lights Mode	local : Use the local schedule below. (P-61 – P-74) Remote : Uses a front-end GP timer.



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No.	Parameter	Description
P-61	Sunday On Time	Sunday On Time
P-62	Sunday Off Time	Sunday Off Time
P-63	Monday On Time	Monday On Time
P-64	Monday Off Time	Monday Off Time
P-65	Tuesday On Time	Tuesday On Time
P-66	Tuesday Off Time	Tuesday Off Time
P-67	Wednesday On Time	Wednesday On Time
P-68	Wednesday Off Time	Wednesday Off Time
P-69	Thursday On Time	Thursday On Time
P-70	Thursday Off Time	Thursday Off Time
P-71	Friday On Time	Friday On Time
P-72	Friday Off Time	Friday Off Time
P-73	Saturday On Time	Saturday On Time
P-74	Saturday Off Time	Saturday Off Time
	DFit	Sets all parameters to their default value

Over Temperature Alarm

P-22. On ML controllers with software version 1.4 and above the alarm will be triggered by the Air Off probe. Previous versions use the Control Temp.

Units

Use this to select the temperature probe type.

- 0 = PT1000 (Deg C)
- 1 = PT1000 (Deg F)
- 2 = NTC2K (Deg C) (Default)
- 3 = NTC2K (Deg F)
- 4 = NTC2K25 (Deg C)
- 5 = NTC2K25 (Deg F)
- 6 = NTC10K (Deg C)
- 7 = NTC10K (Deg F)

Disp.

Display setting: -

- 0 = Decimal display (1 place)
- 1 = Integer Display

Type

The twin compressor controller has only one type so cannot be changed.

ID

Sets the controller ID, (normally used in conjunction with the IP-L network mode). Set a number in the range of 1 – 999

RTC

Real time clock (This will automatically synchronise on network systems)

- a. Use the up or down buttons to scroll through the display until the display reads "rtc"
- b. Press enter. The display will show "t-1". Press enter again
- c. Scroll hours up or down (0 – 23) press enter
- d. Use up button to select "t-2", press enter
- e. Scroll minutes up or down (0 – 59) press enter
- f. Repeat for t-3 (seconds 0 – 59)
- g. Repeat for t-4 (Days up to 31)
- h. Repeat for t-5 (months up to 12)
- i. Repeat for t-6 (Year up to 99)
- j. Use up button to display "ESC", press enter to display "rtc".



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Network Configuration

Network Compatibility

To log the controller onto a network you must first connect the controller to a suitable IP comms module.

Description	Part Number
IP Futura (Single Mercury to IP Interface)	PR0016
Mercury IP Switch (IP support for 10 controllers)	PR0018
Mercury IP Switch with Pressure/Humidity Inputs	PR0018-PHI
ML IP Comms module (Single ML to IP Interface)	PR0108*
ML IP Switch (IP support for 10 controllers)	PR0109*
Mercury IP Switch with Pressure/Humidity Inputs	PR0109-PHI*

When logging the ML controller on to a Data Manager then one of the above communication modules should be used. The ML range of IP communication modules will soon be obsolete with only spares being made available for replacement purposes. For a limited number of software versions the ability to communicate with both the Mercury and ML communication modules has been included in the ML controller software. This revised software will provide compatibility for both ranges for a short time only. Later versions of software will communicate with Mercury communication modules only. The version of ML controller software which communicates with both Mercury and ML communication modules is shown below:

Part Number	Description	Controller Software Version and IP Communication Compatibility					
		PR0123 V2.0–V2.3	PR0123-TWI V2.0–V2.1	PR0123-STA V2.0–V2.1	PR0123 V2.4& Above	PR0123-TWI V2.2 & Above	PR0123-STA V2.2 & Above
PR0108	ML IP Module*	✓	✓	✓	x	X	x
PR0109	ML Hub*	✓	✓	✓	x	x	x
PR0109-PHI	ML Hub PHI*	✓	✓	✓	x	x	x
PR0016	IP Futura	✓	✓	✓	✓	✓	✓
PR0018	Mercury Hub	✓	✓	✓	✓	✓	✓
PR0018-PHI	Mercury Hub PHI	✓	✓	✓	✓	✓	✓

* Note software version of the ML IP Module has to be V1.4 or higher. Software versions older than V1.4 are not supported with the revised ML hardware platform.

The ML controller has to be set depending on the type of communication module in use. See [Hub/Switch](#) Type for further details.

Network Settings

IP Communications

There are 2 ways the ML controller can be used with an IP Ethernet network: -

1. IP-R Remote IP address given by the Data Manager (DHCP Server)
2. IP-L Local IP address and gateway is set up in the controller.

IP-R

To use the ML controller in IP-R mode, you will require either a PR0016 Mercury IP Module or PR0018 Mercury Hub. When either of these two devices are used, the rotary switches be given a unique setting. Setting 000 must be avoided for IP-R mode.

Once the comms module has been set up and connected to the controller and Data Manager, it will automatically log-on. Once it is online, the IP address given to the controller can be viewed by pressing enter at the "NET" display. Press enter at any one of the sub-menu option to read the value

- IP1 = IP address field 1
- IP2 = IP address field 2
- IP3 = IP address field 3
- IP4 = IP address field 4



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IP-L

To use the ML controller in IP-L mode, you will require either a PR0016 Mercury IP Module or PR0018 Mercury Hub.

The rotary switches must be set to 000 on the comms module or 00 on the Hub.

In this mode the IP address and gateway address must be set up manually in the controller.

Use the following table as a guide:

Display	Option
IP1	IP Address byte 1
IP2	IP Address byte 2
IP3	IP Address byte 3
IP4	IP Address byte 4
nL	Network Mask Length (see table below)
GT1	Gateway Address byte 1
GT2	Gateway Address byte 2
GT3	Gateway Address byte 3
GT4	Gateway Address byte 4
ESC	Exit network menu. N.B. this option must be selected to save any changes made in this menu

Setting nL

To ease setup, a single network mask length value is used. If the address has been specified with a network mask value in dotted IP format e.g. 255.255.255.0 then the table below gives the conversion:

Mask	Length	Mask	Length	Mask	Length
		255.255.254.0	23	255.254.0.0	15
255.255.255.252	30	255.255.252.0	22	255.252.0.0	14
255.255.255.248	29	255.255.248.0	21	255.248.0.0	13
255.255.255.240	28	255.255.240.0	20	255.240.0.0	12
255.255.255.224	27	255.255.224.0	19	255.224.0.0	11
255.255.255.192	26	255.255.192.0	18	255.192.0.0	10
255.255.255.128	25	255.255.128.0	17	255.128.0.0	09
255.255.255.0	24	255.255.0.0	16	255.0.0.0	08

The network led will start flashing as the controller is logging on to the network; once logged on, the LED stays on.

Hub/Switch Type

Select the desired value for the type of communication module in use.

0 = Mercury Hub/Switch

1 = ML Hub/Switch

SoFt(Software version)

Press "Enter" at this display to show the software version.

OFSt.

Probe offsets: - select a channel (1 – 4) and select an offset +/- 20 °C (68 °F)



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rLY1

Inverts the operation of relay 1 so that the N/O contact can be used.

ESC

Press enter at this display to quit out of the menu.

Case Off / Sec

If "Case Off" is selected the controller will enter "Case Off Mode" when the case lights schedule is in the off period. When case lights schedule is in the on period the controller will follow its normal control operation. This feature is disabled if Temp Cut-In parameter P-01 is set to 4.0 Degrees or lower.

Warning use with caution: - Case Off places the controller into a state whereby all outputs are **off** and alarms are **inhibited** e.g. no temperature control will occur and no over temperature alarms will be created etc.

If "Sec" is selected the controller will operate to a secondary setpoint, using P-81 (Sec Cut-In), when the case lights schedule is in the off period. When case lights schedule is in the on period the controller will operate to its normal Temperature set point (P-01).

This feature is disabled if Sec Cut-In parameter (P-81) is set to 4.0 Degrees or lower.

Note: The temperature alarm limits do not change so should be set accordingly.

Monitor Probe

Off	If selected probe is not used.
Monitor	If selected, controller will monitor temperature but will not alarm out.
Monitor with Fault	If selected, controller will monitor temperature and alarm out for probe fault but not over or under temperature.
Monitor with Alarm	If selected, controller will monitor temperature and alarm out for probe faults and over and under temperature alarms.
Defrost	The selected probe will be used as a defrost termination probe (instead of Air Off probe).
Plant N/O	If selected, controller will generate a Plant fault alarm when the probe input sees a short circuit.
Plant N/C	If selected, controller will generate a Plant fault alarm when the probe input sees an open circuit

Trim Heater

Trims: If a relay is configured as Trims then the relay will pulse in accordance with P-11 or will be switched remotely by the Data Manager Trim Control energy feature.

P-11 is used if Trim control is not configured in the Data Manager.

Trim Hub: If the relay is configured as Trim Hub then the relay is pulsed remotely by the ML/Mercury Switch (PR0109-PHI/PR0018-PHI) Please see the ML/Mercury Switch user documents for further details.

Relay Assignment

Relay 1	Compressor ^{Note 1}
Relay 2	Fans, Lights, Trims, Solenoid Valve, Alarm, Trim Hub or Compressor
Relay 3	Defrost (use the N/O for correct operation)
Relay 4	Fans, Lights, Trims, Solenoid Valve, Alarm or Trim Hub
Relay 5	Fans, Lights, Trims, Solenoid Valve, Alarm or Trim Hub

Note 1: Normally relay 1 operation is from the lower HP switch N/C contact, if the higher HP switch N/O contact is required for normal operation, then rLy1 option in the menu must be set from its default value 0 to 1.

Note: The relay assigned to Trim and/or SLV will indicate the inverse action on the Data Manager value page.



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Relay State and functional operation

Relay State:	Function State	Wired contact
Relay 1 Off	Compressor 1 On	N/C
Relay 1 On	Compressor 1 Off	N/C
Relay 2 Off	Fans On	N/C
Relay 2 On	Fans Off	N/C
Relay 2 Off	Lights On	N/C
Relay 2 On	Lights Off	N/C
Relay 2 Off	SLV or Trims Off	N/O
Relay 2 On	SLV or Trims On	N/O
Relay 2 Off	Alarm Relay = Alarm	N/C
Relay 2 On	Alarm Relay = OK	N/C
Relay 2 Off	Compressor 2 On	N/C
Relay 2 On	Compressor 2 Off	N/C
Relay 3 Off	Defrost control Off	N/O
Relay 3 On	Defrost control On	N/O
Relay 4/5 Off	Fans On	N/C
Relay 4/5 On	Fans Off	N/C
Relay 4/5 Off	Lights On	N/C
Relay 4/5 On	Lights Off	N/C
Relay 4/5 Off	SLV or Trims Off	N/O
Relay 4/5 On	SLV or Trims On	N/O
Relay 4/5 Off	Alarm Relay = Alarm	N/C
Relay 4/5 On	Alarm Relay = OK	N/C

Sample Data manager Screen Shot (Fan Delay state after a defrost)

Note: Lights and trims have an extra value to indicate the state (This is the control state, not the relay state)

ML45-4 - MLM Case Controller
Online since 15:55 05/05/08

Name	Value	Units	Name	Value	Units
Control temp.	-0.4	°C	Air on Probe	-1.0	°C
Air off Probe	0.1	°C	Probe 3	????????	°C
Probe 4	????????	°C	Plant Fault 1	OK	
Plant Fault 2	OK				
Defrost Control	Off		Fan Control	Off	
Liq. Line Valve	Closed		Lights	On	
Lights Control	On		Inverse Trim Control	Off	
Trims	On		Run Time	0	K Hrs
Setpoint Offset	0.0	°C			
Control State	Fan Delay				

Relay 4 aliased to Lights Control

Relay 2 aliased to Fan Control

Relay 4 aliased to Inverse trim Control



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Front Panel messages

Typical Front Panel messages:

Display Message	System status
Ft	Control Fault
Prb1	Probe 1 Fault
Prb2	Probe 2 Fault
Prb3	Probe 3 Fault
Prb4	Probe 4 Fault
rec	Control State in Recovery
dEF	Control Sate in Defrost
AL	Control State in Alarm (Over or Under Temperature)
OFF	Controller in Case Off

Operation

Lead and Lag Compressor Cut-in

The Lead compressor will come on when the control temperature reaches Lead Cut-In set point and will go off when the control temperature reaches the Lead Cut-In set point minus the Lead Diff. The Lag compressor will come on when the control temperature reaches Lag Cut-In set point and will go off when the control temperature reaches the Lag Cut-In set point minus the Lag Diff. Note compressor starts are also dependant on the anti-short cycle timer status for the given compressor.

There is a fixed 15 second delay from when the lead compressor starts before the lag compressor is allowed to start i.e. if the control temperature rises above Lead cut-In and Lag cut-In rapidly, for example after a defrost, then the lag compressor will come on after a 15 second delay from when the lead compressor started. The valve icon on the display will flash when the lead compressor is running and will be on steady when both compressors are running. The valve icon will be off when both compressors are off.

Lead and Lag Swap Over

The Lead and Lag compressors will swap after every defrost. For example if Compressor 1 is the lead compressor entering into a defrost then on completion of the defrost Compressor 1 will become the lag compressor and Compressor 2 will become the lead compressor. On first power up of the controller Compressor 1 will be assigned as the Lead with Compressor 2 being the Lag compressor.

Anti-Short Cycle

Once a compressor starts the anti-short cycle timer will begin to count. If the time entered for the anti-short cycle parameter is exceeded by the time the compressor is turned off it is immediately available for selection if required. If the time entered for the anti-short cycle parameter is not exceeded by the time the compressor is turned off then the compressor is not available for use until the remaining anti short cycle time expires. For example if P-12 is set to 5 minutes and the lead compressor starts and runs for 3 minutes before going off then the control logic will have to wait 2 minutes before being able to select the lead compressor for use. If the lead compressor is out of the control logic due to the anti-short cycle timer and there is a cooling demand then the lag compressor can still be utilised providing it is not violating its anti-short cycle timer. In this instance the Lag compressor would become the Lead and vice-versa until the next defrost.

Single Compressor Operation

If a single compressor is configured then the Lag cut-in and Lag Diff parameters are ignored. Compressor 1 will come on when the control temperature reaches Lead Cut-In set point and will go off when the control temperature reaches the Lead Cut-In set point minus the Lead Diff setpoint. In this operational mode the valve icon will be steady on when the compressor is running and off when the compressor is not running.

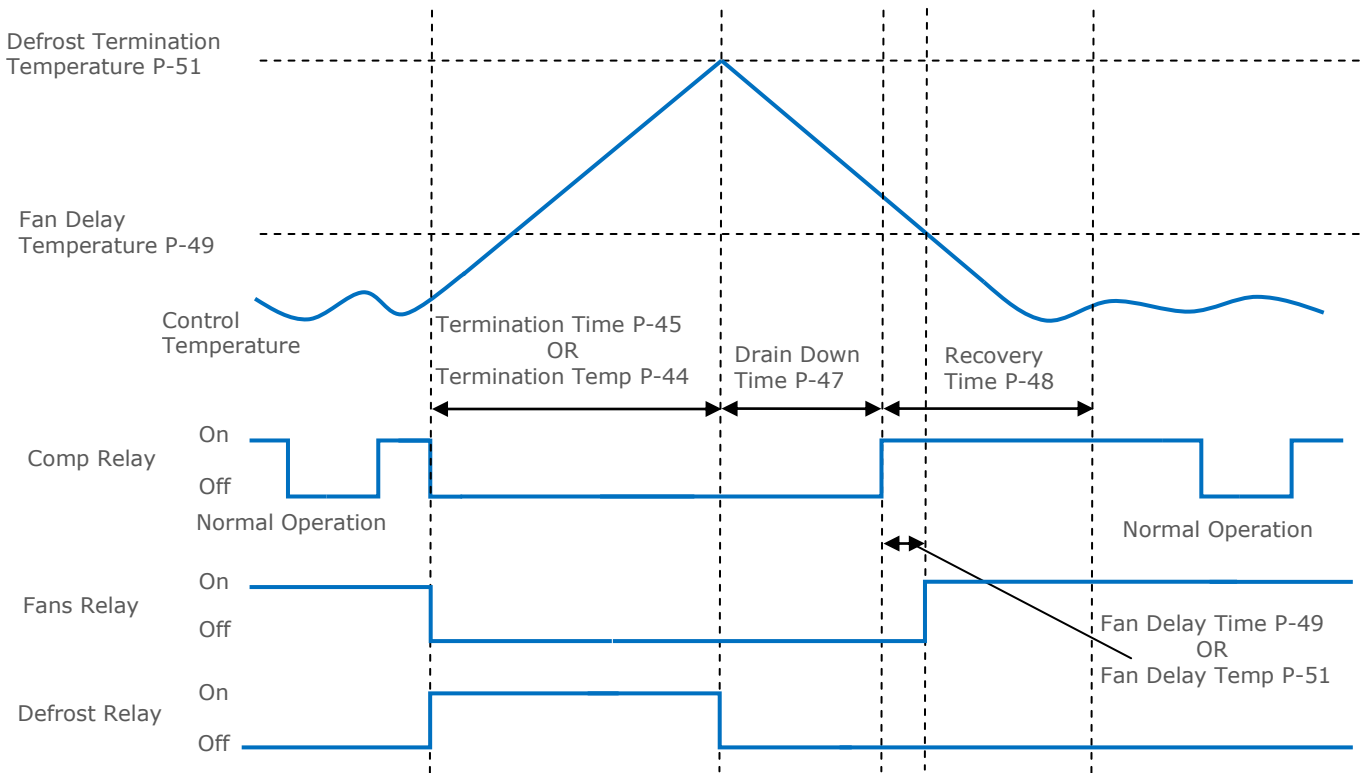
Manual Defrost

Press and hold the “#” key for 3 seconds. A manual defrost in accordance with the defrost parameters will be performed (see defrost page).

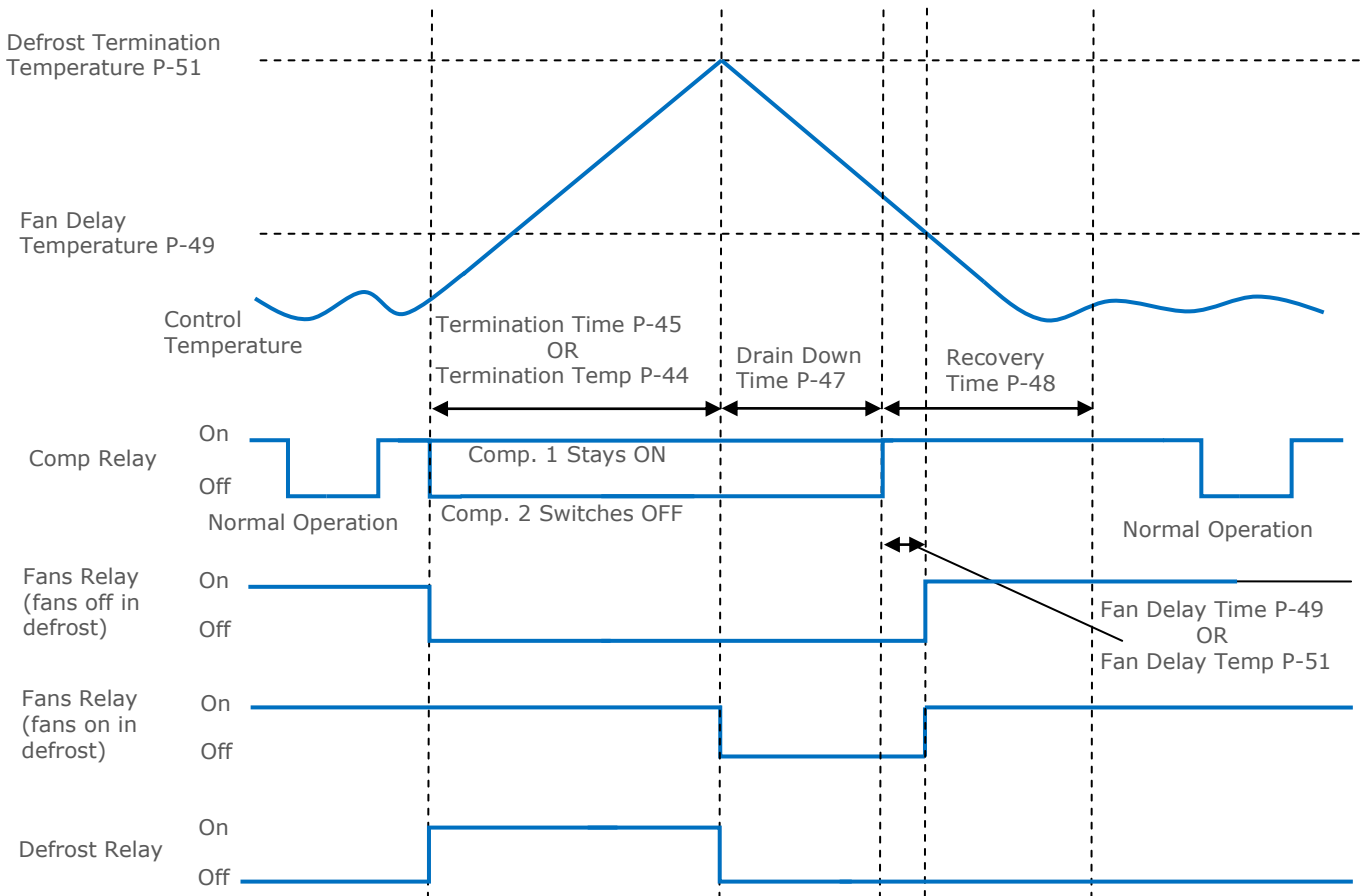


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Electric Defrost Cycle



Gas Defrost Cycle



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From normal operation, when the defrost sequence starts, the fans are switched off (if fans are set to off in defrost, P-50) and the LLV closes. The controller stays in this state until either the termination time (P-45) expires or the termination temperature (p-44) is reached on the defrost termination or air off probe. The controller then enters the drain down period and the fans are switched off. After the drain down period, the LLV is switched on and the recovery period starts. After the fan delay period or when the fans termination temperature drops below the fans set point (P-51), the fans are switched on. Over temperature alarms are inhibited from the start of the sequence to the end of the recovery time. Recovery ends either when the air off temperature drops below the over temperature alarm level or when the recovery time expires.

Network Alarms

Alarm text	Type # (index)
Missed Defrost	15
Over Temperature	4
Under Temperature	5
Log Over Temperature	8
Log Under Temperature	9
Probe 1 Fault	6
Probe 2 Fault	6
Probe 3 Fault	6
Probe 4 Fault	6
Plant Fault 1	3
Plant Fault 2	3

Network Commands

Command	Value to send	Description	Conditions
Defrost Command	1	Initiates a defrost cycle	Defrost mode: remote Once started defrost terminates on temperature or time
Trim Command	0 to 100%	Sets the trim level to this value (Trim period is 5 minutes)	Selectable Relay 2/4/5 mode: Trim Heater
Setpoint Command	$\pm 18^{\circ}\text{C}$	Is added to or subtracted from the setpoint	
Case Off Command	5 0	Sets the controller to Case Off Restores the controller form Case Off to Normal	This command only works when parameter P-98 (Lights Control) Is set to 0 (Off) or 2 (sec) See Note **
Haccp Command	0 1 2	HACCP LED OFF HACCP LED On HACCP LED Flashes	

Note **When parameter P-98 is set to 1 (Case Off) the lights timer will put the controller into Case Off Mode when the case lights go Off



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View I/O

Press "Enter" in the menu at "IO" to view the inputs and outputs.

Number	I/O	Range (dependant on probe type)	Step	Units
I-01	Control Temp.	-60.0 to +60.0	0.1	°C
I-02	Probe 1 (Air On)	-60.0 to +60.0	0.1	°C
I-03	Probe 2 (Air Off)	-60.0 to +60.0	0.1	°C
I-04	Probe 3	-60.0 to +60.0	0.1	°C
I-05	Probe 4	-60.0 to +60.0	0.1	°C
I-11	Plant 1 Input	0 = Off, 1 = On	1	
I-12	Plant 2 Input	0 = Off, 1 = On	1	
I-14	Hub Trim Level	0 to 100	1	%
O-01	Compressor	0 = Off, 1 = On	1	
O-02	Relay 2	0 = Off, 1 = On	1	
O-03	Defrost Control	0 = Off, 1 = On	1	
O-04	Relay 4	0 = Off, 1 = On	1	
O-05	Relay 5	0 = Off, 1 = On	1	
O-06	Lights	0 = Off, 1 = On	1	
O-07	Trims	0 = Off, 1 = On	1	
O-08	Fans	0 = Off, 1 = On	1	
O-09	Compressor 2	0 = Off, 1 = On	1	
O-10	Run Time	0 – 128	1	K Hrs
O-30	Setpoint Offset	-60.0 to +60.0	0.1	°C
O-31	Sec Offset	-60.0 to +60.0	0.1	°C

Specification

General

Supply Voltage Range:	90 – 270 Vac ±10%	
Supply Frequency	50 – 60 Hz ±10%	
Maximum Supply Current	55A	With relays 1 to 5 fully loaded
Typical Supply Current	<1A	With relays 1 to 5 off load
Supply Fuse	1Amp anti-surge 20 x 5mm	
Operating temperature range	+5°C to 50 °C	
Storage temperature	-20°C to 65°C	
Operating Humidity	80% maximum	
Environmental	Indoor use at altitudes up to 2000m, Pollution Degree 1 Installation Category II. Voltage fluctuations not to exceed ±10% of nominal voltage	
Controller Size	79mm x 37mm x 73mm WxHxD	
Panel Cut-out for Controller	72mm x 29mm	
Relay Board Size	170mm x 157mm x 52mm LxWxH	NB – width includes mounting feet
Maximum Weight (combined)	1.25kg	
Safety (Relay Board)	Class II LVD	This product is double insulated when used with the original enclosure
Safety (Controller)	Class II LVD	Only use the cable provided to connect the controller to the relay board.
Safety	Conforms to EN60730-1 based on UL 60950-1; UL 62368-1 as referenced to IEC60730-1	
EMC	EN61326-1 : 2013	
Ventilation	No requirement for forced ventilation	
Insulation	Class I for Relay board Class II for controller	



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Relays

IMPORTANT: Some early versions of Relay modules had relays fitted in position 1 that had a lower N/O contact rating (0.5 HP) Look at the label on the enclosure lid for the correct Relay rating.

Relay 1 Compressor Relay ^{Note 1}	N/O contact 250 Vac/16A N/O contact 250 Vac/ 2HP N/C contact 250 Vac/16A N/C contact 250 Vac/1.5HP	Resistive Load Motor Load Resistive Load Motor Load
Relay 2 Selectable	N/C contact 240 Vac/10A N/C contact 240 Vac/3A N/O contact 240 Vac/10A N/O contact 240 Vac/3A	Resistive Load Inductive Load Cos Φ =0.4 Resistive Load Inductive Load Cos Φ =0.4
Relay 3 Defrost	N/C contact 240 Vac/10A N/C contact 240 Vac/3A N/O contact 240 Vac/10A N/O contact 240 Vac/3A	Resistive Load Inductive Load Cos Φ =0.4 Resistive Load Inductive Load Cos Φ =0.4
Relay 4 Selectable	N/C contact 240 Vac/10A N/C contact 240 Vac/3A N/O contact 240 Vac/10A N/O contact 240 Vac/3A	Resistive Load Inductive Load Cos Φ =0.4 Resistive Load Inductive Load Cos Φ =0.4
Relay 5 Selectable	N/C contact 240 Vac/10A N/C contact 240 Vac/3A N/O contact 240 Vac/10A N/O contact 240 Vac/3A	Resistive Load Inductive Load Cos Φ =0.4 Resistive Load Inductive Load Cos Φ =0.4

Note 1 Normally relay 1 operation is from the lower HP NC contact, if the higher HP NO contact is required for normal operation, the relay 1 option in the menu must be set from its default value (0) to 1.

Damage to relays through out of specification usage will invalidate the warranty.

Part Numbers

Controller Variant	Part Number
ML Twin Compressor Controller with 5 Relay, RS232 Comms and Screw Terminals	PR0123-TWI
ML Twin Compressor Controller with 5 Relay, RS232 Comms and Screw Terminals (50 Units)	PR0123-TWI-50
ML Twin Compressor Controller with 5 Relay, RS232 Comms and Screw Terminals (20 Units)	PR0123-TWI-20
Each of the above units are supplied with a Controller Display, Display Cable, Relay Board and two PRO240 Probes (NTC2K probe type with a 7 Metre cable)	
ML PSU Relay module with 5 Relay, RS232 Comms and Screw Terminals	PR0127
ML PSU Relay module with 5 Relay, RS232 Comms and Screw Terminals (50 Units)	PR0127-50
ML PSU Relay module with 5 Relay, RS232 Comms and Screw Terminals (20 Units)	PR0127-20

Alarm Sounder

The sounder is not included or fitted to the standard build but it is an optional build for quantity orders.



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Appendix1: ML Twin Compressor Modbus® address registers

Register	Name	Min	Max	Unit	Register Type	Item Type		
0	Control temp.	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
1	Air On Probe	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
2	Air Off Probe	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
3	Probe 3	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
4	Probe 4	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
5	Plant Fault 1	0 = Unused			3 – Holding	Word		
		1 = OK						
		2 = Alarm						
6	Plant Fault 2	0 = Unused			3 – Holding	Word		
		1 = OK						
		2 = Alarm						
7	Hub Trim Level	0	100	%	3 – Holding	Word	× 1	
4096	Compressor	0 = Off			3 – Holding	Word		
		1 = On						
4097	Comp 2	0 = On			3 – Holding	Word		
		1 = Off						
4098	Defrost Control	0 = Off			3 – Holding	Word		
		1 = On						
4099	Lights	0 = Off			3 – Holding	Word		
		1 = On						
4100	Fans	0 = On			3 – Holding	Word		
		1 = Off						
4101	Trims	0 = On			3 – Holding	Word		
		1 = Off						
4102	Trims	0 = Off			3 – Holding	Word		
		1 = On						
4103	Run Time	0	128	K Hrs	3 – Holding	Word	× 1	
4104	Setpoint Offset	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
12288	Control State	0 = Stabilise			3 – Holding	Word		
		1 = Normal						
		2 = Defrost						
		3 = Drain Down						
		4 = Fan Delay						
		5 = Recovery						
		6 = Alarm						
		7 = Case Off						



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Register	Name	Min	Max	Unit	Register Type	Item Type		
20480	Defrost Command	0 = Normal			3 – Holding	Word		
		1 = Defrost						
		2 = ElecDf						
		3 = DefTerm						
		4 = Standby						
		5 = CaseOff						
		6 = FansOnly						
20481	Trim Command	0	100	%	3 – Holding	Word	× 1	
20482	Setpoint Command	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
20483	Case Off Command	0 = Normal			3 – Holding	Word		
		1 = Defrost						
		2 = ElecDf						
		3 = DefTerm						
		4 = Standby						
		5 = CaseOff						
		6 = FansOnly						
20484	Haccp Command	0 = Off			3 – Holding	Word		
		1 = On						
		2 = Flash						
20485	EEV Command	0 = Local			3 – Holding	Word		
		1 = Normal						
		2 = Close						
		3 = Open						
24576	Unused				3 – Holding	Word		
24577	Missed Defrost				3 – Holding	Word		
24578	Probe 1 Fault				3 – Holding	Word		
24579	Probe 2 Fault				3 – Holding	Word		
24580	Probe 3 Fault				3 – Holding	Word		
24581	Probe 4 Fault				3 – Holding	Word		
24582	Plant 1 Fault				3 – Holding	Word		
24583	Plant 2 Fault				3 – Holding	Word		
24584	Over Temperature				3 – Holding	Word		
24585	Under Temperature				3 – Holding	Word		
24586	Log Over Temperature				3 – Holding	Word		
24587	Log Under Temperature				3 – Holding	Word		
8192	Temp Cut-In				-60 (-76)	60 (140)		
8193	Temp Diff	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
8194	Control weight	0	100	%	3 – Holding	Word	× 1	



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Register	Name	Min	Max	Unit	Register Type	Item Type		
8195	Probe 3 Type	0 = Off			3 – Holding	Word		
		1 = Prb						
		2 = Prb/Flt						
		3 = Prb/Alm						
		4 = Prb/Defrost						
		5 = PltN/O						
		6 = PltN/C						
8196	Probe 4 Type	0 = Off			3 – Holding	Word		
		1 = Prb						
		2 = Prb/Flt						
		3 = Prb/Alm						
		4 = Prb/Defrost						
		5 = PltN/O						
		6 = PltN/C						
8197	Relay 2 Type	0 = Fans			3 – Holding	Word		
		1 = Lights						
		2 = Trim						
		3 = Alarm						
		4 = SLV						
		5 = Trim Hub						
8198	Relay 4 Type	0 = Fans			3 – Holding	Word		
		1 = Lights						
		2 = Trim						
		3 = Alarm						
		4 = SLV						
		5 = Trim Hub						
8199	Relay 5 Type	0 = Fans			3 – Holding	Word		
		1 = Lights						
		2 = Trim						
		3 = Alarm						
		4 = SLV						
		5 = Trim Hub						
8200	Trim Level	0	100	%	3 – Holding	Word	× 1	
8201	Anti SC Time	00:00	99:00	mm:ss	3 – Holding	Word	× 60	
8202	Max Run Time	00:00	99:00	mm:ss	3 – Holding	Word	× 60	
8203	Service Time	0	128	K Hrs	3 – Holding	Word	× 1	
8204	OT/UT alarm dly	00:00	99:00	mm:ss	3 – Holding	Word	× 60	
8205	Under Temp Alm	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
8206	Over Temp Alm	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
8207	Log Alarm Delay	00:00	99:00	mm:ss	3 – Holding	Word	× 60	z
8208	Log U/T Alarm	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
8209	Log O/T Alarm	-60 (-76)	60	C (F)	3 – Holding	Word	÷ 10	Extend



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Register	Name	Min	Max	Unit	Register Type	Item Type		
			(140)					
8210	Alarm Duration	00:00	61:00	mm:ss	3 – Holding	Word	× 60	
8211	Defrost Mode	0 = Local			3 – Holding	Word		
		1 = Remote						
8212	Defrost Start	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8213	Defrost Number	0	8		3 – Holding	Word	× 1	
8214	No Defrost Time	0	180	Hours	3 – Holding	Word	× 1	
8215	Def. Term. Temp	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
8216	Defrost Time	00:00	99:00	mm:ss	3 – Holding	Word	× 60	
8217	Defrost Type	0 = Elec			3 – Holding	Word		
		1 = Gas						
		2 = Off Cycle						
8218	Drain down Time	00:00	24:00	mm:ss	3 – Holding	Word	× 15	
8219	Recovery Time	00:00	99:99	mm:ss	3 – Holding	Word	× 60	
8220	Fan Delay Time	00:00	99:99	mm:ss	3 – Holding	Word	× 60	
8221	Fans in Def	0 = Off			3 – Holding	Word		
		1 = On						
8222	Fan Delay Temp	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	
8223	Lights Ctrl	0 = Off			3 – Holding	Word		
		1 = Case Off						
		2 = Sec						
8224	Sec Cut-In	-60 (-76)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Extend
8225	Lights Mode	0 = Local			3 – Holding	Word		
		1 = Remote						
		2 = ManOff						
		3 = ManOn						
8226	Sun Lights On	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8227	Sun Lights Off	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8228	Mon Lights On	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8229	Mon Lights Off	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8230	Tue Lights On	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8231	Tue Lights Off	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8232	Wed Lights On	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8233	Wed Lights Off	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8234	Thu Lights On	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8235	Thu Lights Off	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8236	Fri Lights On	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8237	Fri Lights Off	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8238	Sat Lights On	00:00	23:59	hh:mm	3 – Holding	Word	× 1	
8239	Sat Lights Off	00:00	23:59	hh:mm	3 – Holding	Word	× 1	



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Revision History

Revision	Date	Changes
V2.2	20/06/2011	New layout and diagrams
V2.2a	06/03/2015	Modbus ® Address Table Added
V2.3	11/05/2015	470R, 700R, 3K, 5K, 6K and NTC10K(2) probe type added
V2.3a	29/10/2015	EMC standard updated & Part numbers amended.
V2.3b	12/01/2017	Compressor numbers added in gas defrost diagram.
V2.3c	16/03/2017	Defrost line diagram on page 14 amended to show fans off in drain down when fans set to on in defrost.
V2.3d	29/08/2017	Part number for 50 units corrected.
V2.3e	17/04/2018	New documentation format.
V2.3f	20/01/2020	Update to Specification
V2.3g	15/04/2020	Sounder not included in standard build option.



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Group Offices

RDM Group Head Office

80 Johnstone Avenue
Hillington Industrial Estate
Glasgow
G52 4NZ
United Kingdom

+44 (0)141 810 2828
support@resourcedm.com

RDM USA

9441 Science Center Drive
New Hope
Minneapolis
MN 55428
United States

+1 612 354 3923
usasupport@resourcedm.com

RDM Asia

Sky Park at One City
Jalan USJ 25/1
47650 Subang Jaya
Selangor
Malaysia

+60 3 5022 3188
asiatech@resourcedm.com



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