

**Intuitive
PR0659**



**Plant
PR0609**

Intuitive & Plant Backup Controller Installation & User Guide

Resource Data Management Ltd

80 Johnstone Avenue, Hillington Industrial Estate,
Glasgow, Scotland G52 4NZ UK

☎ +44(0)141 810 2828

✉ support@resourcedm.com

✉ sales@resourcedm.com

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The Intuitive & Plant Backup Controller

From Resource Data Management

This documentation refers to the Intuitive & Plant Backup Controllers

Description

The Backup controllers are intended as a backup system for the primary pack/condenser controller. The controllers have built in displays which allow for setup of the units as well as interrogating the controller. There are 12 relay outputs used to operate compressors, loaders, condenser fans or act as a standby relay used to place the primary pack/condenser controller into standby. Relays can also be assigned as Inverter enable relays to activate a variable speed device. There are two analogue Inputs for pressure transducers which can be set either as 0-10Vdc or 4-20mA. There are 2 analogue outputs used to control variable speed devices and either output can be set to 4-20mA or 0-10Vdc. There are 2 digital inputs which are used to return control to the primary pack/condenser controller if the backup controller is enabled. There are a number of software configuration options which can be selected during setup of the controller and they are shown in the Configuration section below.

All relays are volt-free and can be mixed between low and high voltage sources. The controllers require a 24Vac supply or 24Vdc PSU (Available from RDM: - PR0625)

Configuration

The controllers have seven configuration options: -

Types

Display value	Type
1	LT Pack
2	HT Pack
3	HT & LT Pack
4	Condenser
5	Dual Condenser
6	LT Pack & Condenser
7	HT Pack & Condenser

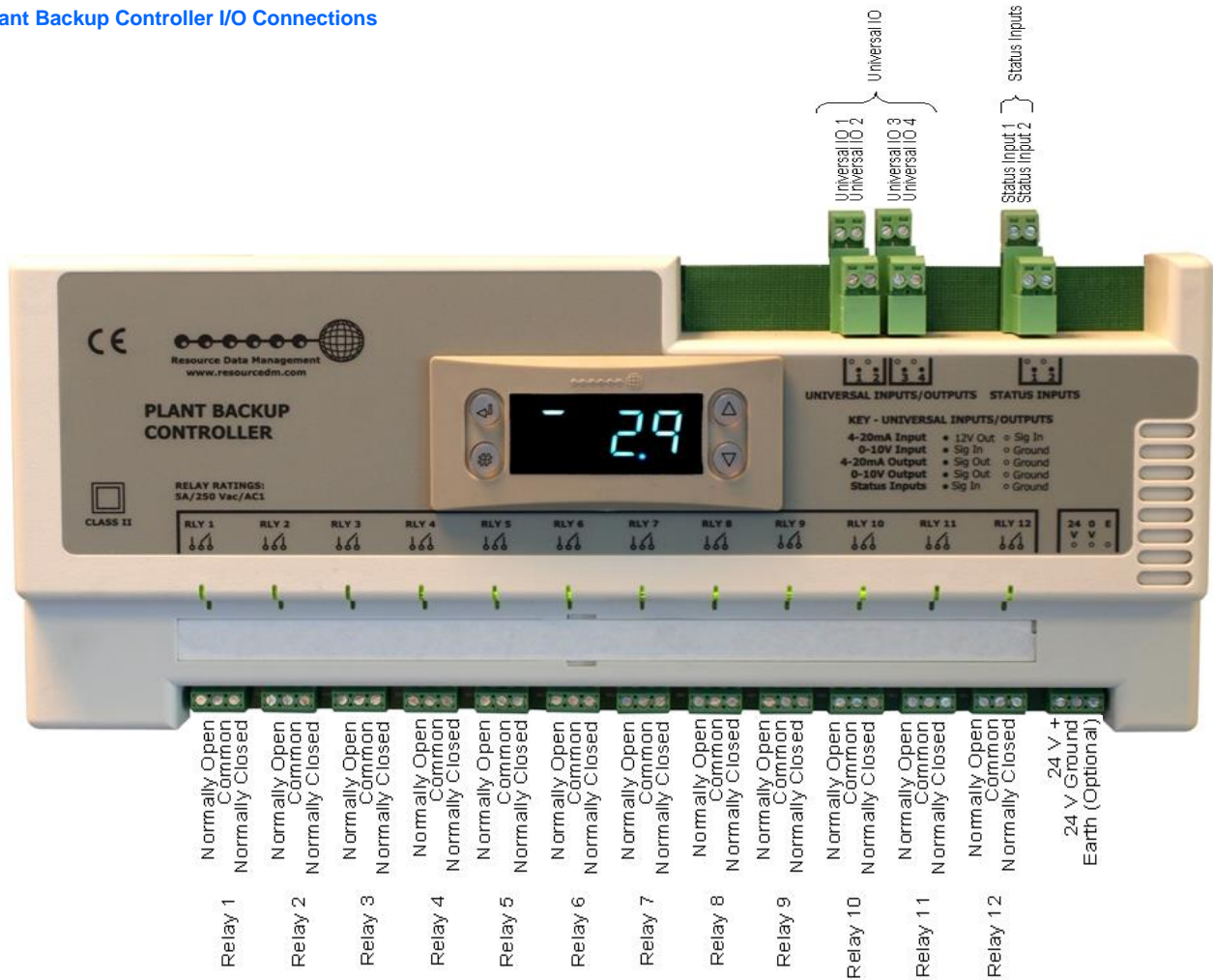
The controllers are delivered pre-configured as an LT Pack Controller (Type 1)

See: [Set-up](#) to change the controller type.

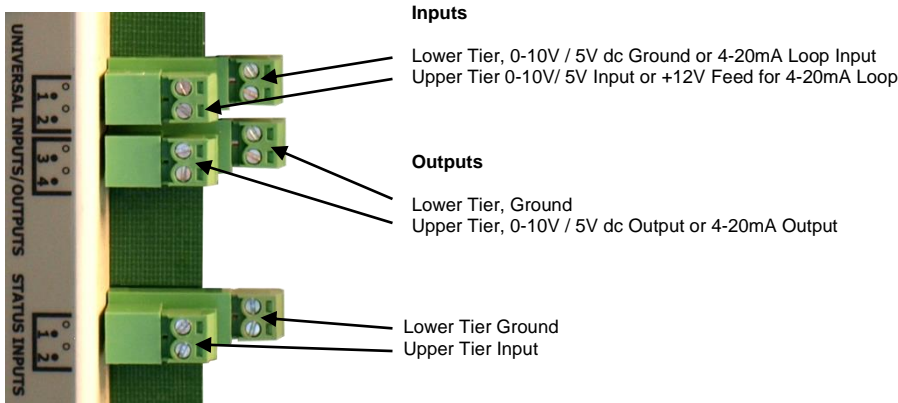


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Plant Backup Controller I/O Connections

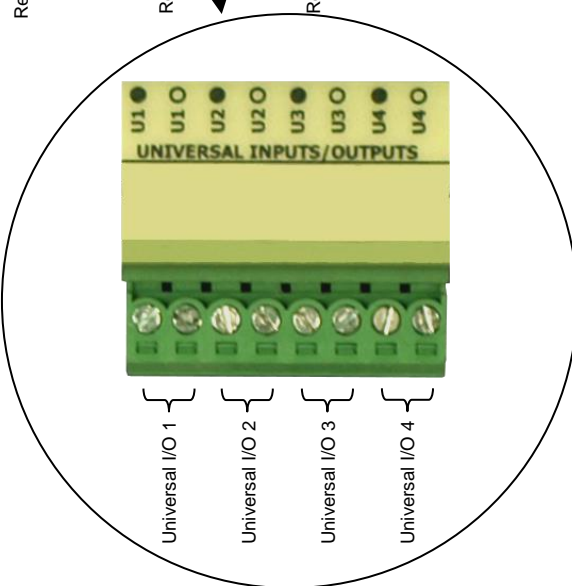
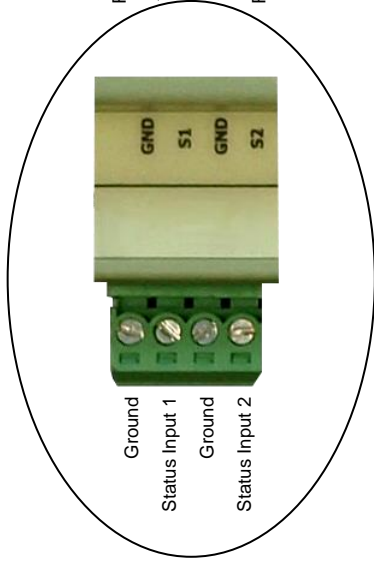
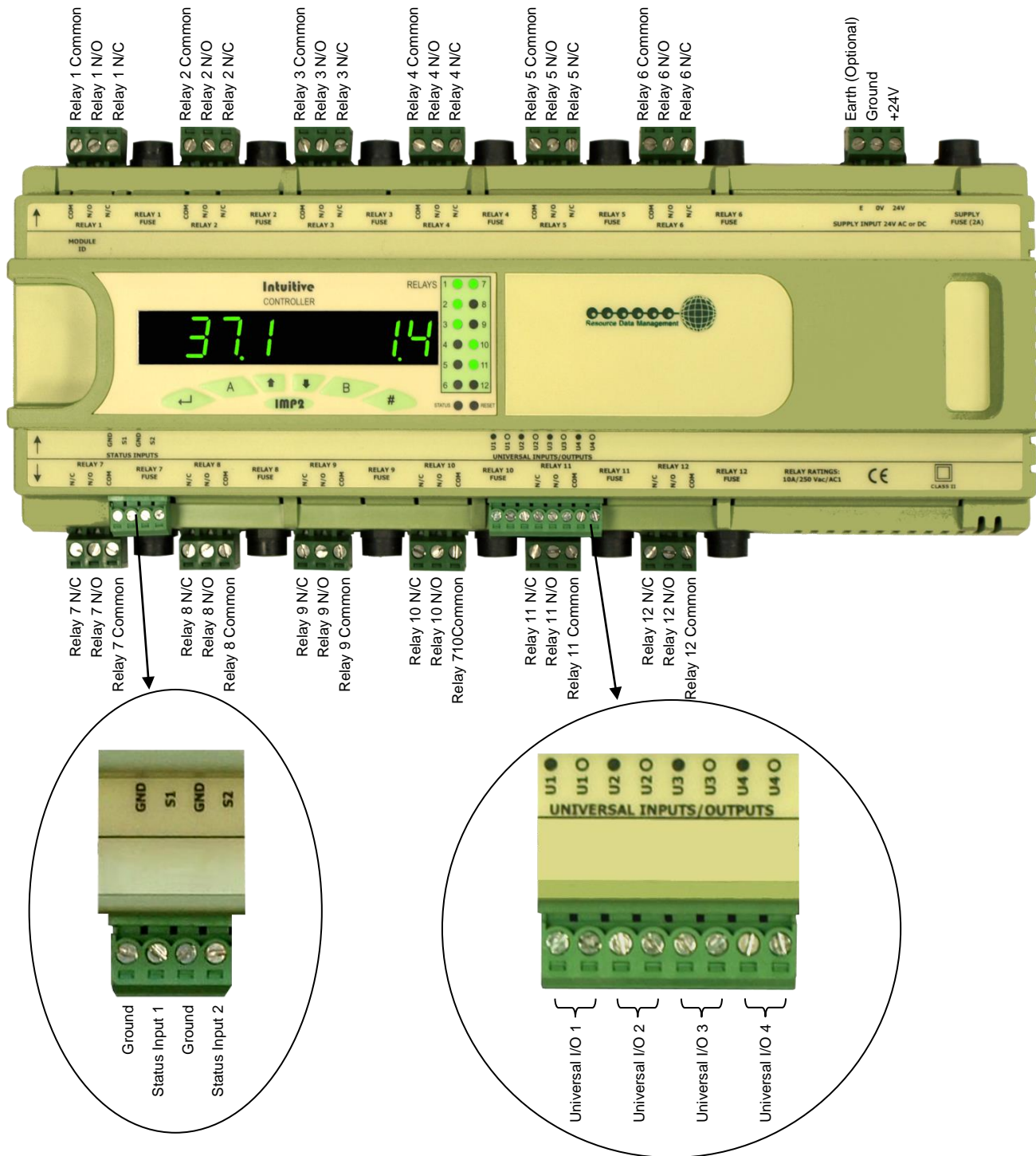


Universal Inputs/Outputs



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Intuitive Backup Controller I/O Connections



Universal Inputs/Outputs

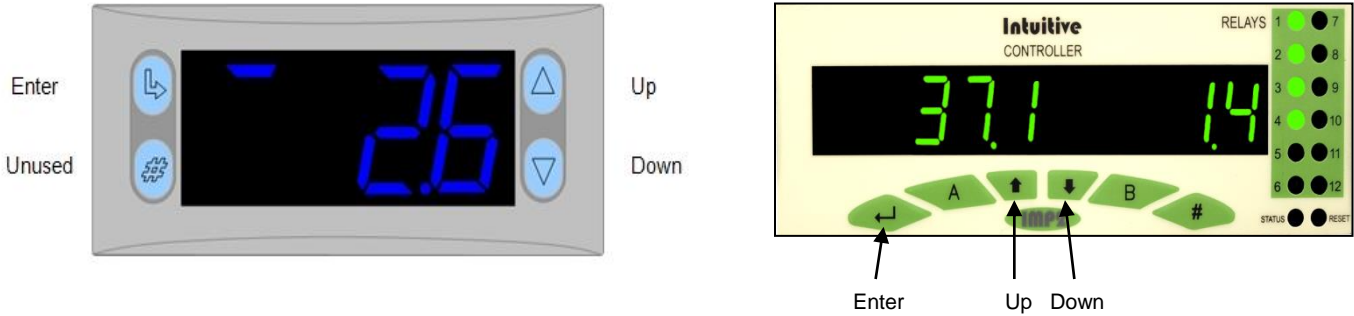
0-10V or 4 -20mA Input/Outputs	
U1-U2 ●	4-20mA Loop Input or 0-10V / 5V Ground
U1-U2 ○	12v Transducer Feed or 0-10V / 5V Input
U3-U4 ●	Ground
U3-U4 ○	4-20mA Output or 0-10V / 5V Output



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Setting up the controller

Set-up access to the controller can be achieved through the front mounted buttons on the display



- Enter Button: - Used to confirm settings or enter software menus.
 - Up Button: - Used to scroll up through menu options
 - Down Button: - Used to scroll down through menu options
- Other buttons are not used.

Display Operation

If the Type selected has 2 sections then the plant controller display alternates between section 1 pressure and section 2 pressure. The bar on the left hand side of the display indicates which section is currently being displayed. When section 1 pressure is displayed the bar is at the top. When section 2 pressure is displayed the bar is at the bottom of the display.

Plant Controller Display

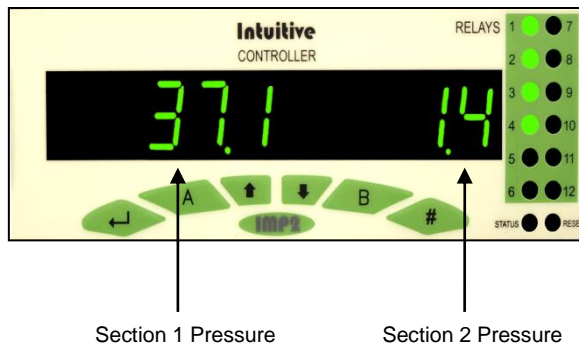
Section 1 Pressure

Section 2 Pressure



Intuitive Controller Display

The Intuitive controller display shows section 1 pressure on the left and section 2 Pressure on the right.



Note: If "Ft" is displayed in either display, this indicates a transducer fault. "Ft" in the left hand display indicates section 1 transducer is faulty, "Ft" in right hand display indicates section 2 transducer is faulty.



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Inputs & Outputs

All Types	Description	Comments
Status Input 1 & 2	0V return or 24 Vac	Section 1 & 2 Reset Note 1
Universal Input/Output 1 & 2	4-20mA or 0-10Vdc	Section 1 & 2 Suction / Discharge Transducer
Universal Input/Output 3 & 4	4-20mA or 0-10Vdc	Section 1 & 2 Inverter output
Relay 1 to 12	N/O, N/C and Common	Comp or Fan or Inverter Enable or Standby Relay : Note 2

Note 1:

The Plant Backup controller will remain inactive should the corresponding reset input be present or the relevant pressure transducer is faulty.

24 Vac must have the same 24 Vac return as the supply voltage. If using the Plant controller 24V power supply only the 24Vac signal from the supply is required for the digital input.

Note 2:

All relay outputs for compressors, fans, inverter enable and standby are wired to the normally open contacts.

Set-up Mode

To enter set-up mode, hold the Enter and Down buttons together for approximately 3 seconds until the message "Ent" appears on the display. Now press the Enter button again to enter the function menu. IO will be displayed. Scroll up or down to go through the list

Set-up Function Menu

Display	Option	Menu Item seen in type:	Explained in Paragraph
IO	View Input/Output States	All types	View Input/Output States
PArA	Set/view Parameters	All types	Set/view Parameters
tyPE	Set/View Controller Type	All types	Set/view Configuration Type
SoFt	View software version	All types	
ESC	Exit set-up mode		

Recommended set-up method

type. Set/view controller type

1. From the function menu scroll to "type", press enter
2. Use the up/down buttons to scroll through the type values. (See [configuration](#) on page 3)
3. Press enter.

The controller will reset with the selected type now programmed.

PArA. Set/view parameters

1. From the function menu scroll to PArA
2. Pressing Enter while PArA is displayed will enter the parameter menu.

The first parameter option will be displayed as P-01. Pressing the Up or Down button will present the other parameter options P-02, P-03 etc. See the parameter list below to find what parameter number corresponds to which actual parameter.

Pressing the Enter button will show the current value of the selected parameter. Press Up or Down to modify the value and press Enter again to save the value. The parameter list number will be displayed again.

Two other options are present in the parameter menu – dFLt and ESC. Selecting ESC will exit the parameter set-up mode. Selecting dFLt will reset all parameters back to the default values for the current controller type.



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Parameter Tables

No.	Parameter	Range	Step	Units	LT Pack (Type 1)	HT Pack (Type 2)	HT & LT Pack (Type 3)	Condenser (Type 4)	Dual Condenser (Type 5)	LT Pack & Cond (Type 6)	HT Pack & Cond (Type 7)
P-01	Sect 1 Suction Setpoint	-3.4 to 180	0.1	Bar	0.7	3.4	3.4			0.7	3.4
P-02	Sect 1 Suction Diff	-3.4 to 180	0.1	Bar	0.2	0.7	0.7			0.2	0.7
P-05	Sect 1 Low Suction Setpoint	-3.4 to 180	0.1	Bar	0.2	2.0	2.0			0.2	2.0
P-06	Sect 1 Low Suction Delay	00:00 to 99:00	01:00	mm:ss	20:00	20:00	20:00			20:00	20:00
P-09	Sect 1 High Suction Setpoint	-3.4 to 180	0.1	Bar	2.0	5.0	5.0			2.0	5.0
P-10	Sect 1 High Suction Delay	00:00 to 99:00	01:00	mm:ss	20:00	20:00	20:00			20:00	20:00
P-30	Sect 1 On Delay	00:00 to 60:00	00:01	mm:ss	01:00	01:00	01:00	01:00	01:00	01:00	01:00
P-31	Sect 1 Off Delay	00:00 to 60:00	00:01	mm:ss	01:00	01:00	01:00	01:00	01:00	01:00	01:00
P-40	Sect 1 Number of Relays	2 to 12	1	-	12	12	6	12	6	12	6
P-50	Sect 1 Control Test. See Test	0 = Off. 1 = On	1	-	0	0	0	0	0	0	0
P-60	Sect 1 Transducer Span *	-3.4 to 180	0.1	Bar	9.0	9.0	9.0	30.0	30.0	9.0	9.0
P-61	Sect 1 Transducer Offset	-3.4 to 180	0.1	Bar	-1.0	-1.0	-1.0	0.0	0.0	-1.0	-1.0
P-62	Sect 1 Transducer Calibration	-3.4 to 180	0.1	Bar	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P-70	Sect 1 Inverter Output Enable	0 = Off. 1 = On	1	-	0	0	0	0	0	0	0
P-71	Sect 1 Inverter response	0 to 100	1	-	5	5	5	5	5	5	5
P-80	Sect 1 Transducer Type	0 = 4-20mA. 1 = 0-10V	1	-	0	0	0	0	0	0	0
P-82	Sect 1 Inverter Output Type	0 = 4-20mA. 1 = 0-10V	1	-	0	0	0	0	0	0	0
P-20	Sect 1 Discharge Setpoint	-3.4 to 180	0.1	Bar				12	12		
P-21	Sect 1 Discharge Diff	-3.4 to 180	0.1	Bar				0.2	0.2		
P-24	Sect 1 High Discharge Setpoint	-3.4 to 180	0.1	Bar				19.5	19.5		
P-03	Sect 2 Suction Setpoint	-3.4 to 180	0.1	Bar			0.7				
P-04	Sect 2 Suction Diff	-3.4 to 180	0.1	Bar			0.2				
P-07	Sect 2 Low Suction Setpoint	-3.4 to 180	0.1	Bar			0.2				
P-08	Sect 2 Low Suction Delay	00:00 to 99:00	01:00	mm:ss			20:00				
P-11	Sect 2 High Suction Setpoint	-3.4 to 180	0.1	Bar			2.0				
P-12	Sect 2 High Suction Delay	00:00 to 99:00	01:00	mm:ss			20:00				
P-32	Sect 2 On Delay	00:00 to 60:00	00:01	mm:ss			01:00		01:00	01:00	01:00
P-33	Sect 2 Off Delay	00:00 to 60:00	00:01	mm:ss			01:00		01:00	01:00	01:00
P-41	Sect 2 Number of Relays	2 to 12	1	-			6		6	6	6
P-51	Sect 2 Control Test. See Test	0 = Off. 1 = On	1	-			0		0	0	0
P-63	Sect 2 Transducer Span	-3.4 to 180	0.1	Bar			9.0		30.0	30.0	30.0
P-64	Sect 2 Transducer Offset	-3.4 to 180	0.1	Bar			-1.0		0.0	0.0	0.0
P-65	Sect 2 Transducer Calibration	-3.4 to 180	0.1	Bar			0.0		0.0	0.0	0.0
P-72	Sect 2 Inverter Output Enable	0 = Off. 1 = On	1	-			0		0	0	0
P-73	Sect 2 Inverter response	0 to 100	1	-			5		5	5	5
P-81	Sect 2 Transducer Type	0 = 4-20mA. 1 = 0-10V	1	-			0		0	0	0
P-83	Sect 2 Inverter Output Type	0 = 4-20mA. 1 = 0-10V	1	-			0		0	0	0
P-22	Sect 2 Discharge Setpoint	-3.4 to 180	0.1	Bar					12	12	12
P-23	Sect 2 Discharge Diff	-3.4 to 180	0.1	Bar					0.2	0.2	0.2
P-25	Sect 2 High Discharge Setpoint	-3.4 to 180	0.1	Bar					19.5	19.5	19.5
dFLt	Restore Default Settings (Front panel Only)										

* Transducer Span and Offset allows for the full range of the transducer to be used by the controller. Transducer Span is the full range of the transducer. Transducer Offset is the value below zero.

Example: Danfoss AKS 33 with range: -1 bar to 12 bar
Span would be 13 bar
Offset would be -1 bar

Transducer Calibration is used to calibrate the Controllers pressure reading to that of calibrated gauges.

Note. The controller uses absolute pressure; if gauge pressure is required, add +1 Bar to the offset value.



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Parameter Description

Number	Parameter	Description
P-01	Section 1 Suction Setpoint	Pressure target, control will try to maintain this pressure
P-02	Section 1 Suction Diff	Set point below the target.
P-03	Section 2 Suction Setpoint	Pressure target, control will try to maintain this pressure
P-04	Section 2 Suction Diff	Set point below the target.
P-05	Section 1 Low Suction Setpoint	Pressure at which the backup controller becomes active and places the primary controller into standby (After delay expires)
P-06	Section 1 Low Suction Delay	Delay before backup controller takes over after parameter P-05 pressure has been reached.
P-07	Section 2 Low Suction Setpoint	Pressure at which the backup controller becomes active and places the primary controller into standby (After delay expires)
P-08	Section 2 Low Suction Delay	Delay before backup controller takes over after parameter P-07 pressure has been reached.
P-09	Section 1 High Suction Setpoint	Pressure at which the backup controller becomes active and places the primary controller into standby (After delay expires)
P-10	Section 1 High Suction Delay	Delay before backup controller takes over after parameter P-09 pressure has been reached
P-10	Section 1 High Suction Delay	Delay before backup controller takes over after parameter P-09 pressure has been reached
P-11	Section 2 High Suction Setpoint	Pressure at which the backup controller becomes active and places the primary controller into standby (After delay expires)
P-12	Section 2 High Suction Delay	Delay before backup controller takes over after parameter P-11 pressure has been reached
P-20	Section 1 Discharge Setpoint	Pressure target, control will try to maintain this pressure
P-21	Section 1 Discharge Diff	Set point below the target.
P-22	Section 2 Discharge Setpoint	Pressure target, control will try to maintain this pressure
P-23	Section 2 Discharge Diff	Set point below the target.
P-24	Section 1 High Discharge Setpoint	Pressure at which the backup controller becomes active and places the primary controller into standby (No delay)
P-25	Section 2 High Discharge Setpoint	Pressure at which the backup controller becomes active and places the primary controller into standby (No delay)
P-30	Section 1 On Delay	Delay between stages turning On
P-31	Section 1 Off Delay	Delay between stages turning Off
P-32	Section 2 On Delay	Delay between stages turning On
P-33	Section 2 Off Delay	Delay between stages turning Off
P-40	Section 1 Number of Relays	Number of stages in the system. See: Relay Assignment
P-41	Section 2 Number of Relays	Number of stages in the system. See: Relay Assignment
P-50	Section 1 Control Test	See: Test
P-51	Section 2 Control Test	See : Test
P-60	Section 1 Transducer Span	Range of the transducer
P-61	Section 1 Transducer Offset	Transducer value below zero
P-62	Section 1 Transducer Calibration	Used to calibrate the controllers pressure to that of calibrated gauges
P-63	Section 2 Transducer Span	Range of the transducer
P-64	Section 2 Transducer Offset	Transducer value below zero
P-65	Section 2 Transducer Calibration	Used to calibrate the controllers pressure to that of calibrated gauges
P-70	Section 1 Inverter Output Enable	Enables the inverter analogue output
P-71	Section 1 Inverter response	Speed up/slow down stage On/Off speed
P-72	Section 2 Inverter Output Enable	Enables the inverter analogue output
P-73	Section 2 Inverter response	Speed up/slow down stage On/Off speed
P-80	Section 1 Transducer Type	Selects Transducer type 4-20mA or 0-10V
P-81	Section 2 Transducer Type	Selects Transducer type 4-20mA or 0-10V
P-82	Section 1 Inverter Output Type	Selects Inverter output type 4-20mA or 0-10V
P-83	Section 2 Inverter Output Type	Selects Inverter output type 4-20mA or 0-10V



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Relay Assignment

The number of relays used by each section is defined by the parameter “Number of relays” (P-40/41). This number includes the inverter enable relay, if used, the total number of compressor/fan stages required and the standby relay. (This differs from the Main RDM controller which does not have a backup relay per section)

Inverter Output Relay

If the parameter “Section 1 Inverter Output Enable” or “Section 2 Inverter Output Enable” is set to on then the first relay for each section will become the Inverter output enable relay. This relay is energised whenever the analogue Inverter output is active.

Standby Relay(s)

The standby relay is always the last relay in the total number of relays configured for each section. For example, if the controller is configured as an HT pack and condenser (type 7) with 3 compressors and a single inverter output on the condenser section then section 1 number of relays (P-40) would be set to 4, relays 1, 2 & 3 are assigned as compressor relays and the 4th relay would be the standby relay for section 1.

Section 2 stages would start on relay 5, which would be allocated as the fan inverter enable relay and relay 6 would be the standby relay for section 2, the number of relays on section 2 would be set to 2 (P-41).

The Standby relay is energised when the High Suction Setpoint or Low Suction Setpoint or Discharge Setpoint is reached and the relevant delay has expired. The Standby relay(s) is de-energised when control is returned to the primary pack/condenser controller.

Operation

Control Enabled

If the controller is set to a two section variant then section 1 and 2 can be enabled independently of each other and are active when the following conditions are met.

For a Pack section the input pressure is compared with the high limit and low limit parameters (P-05/07/09/11) together with the corresponding delay parameter (P-06/08/10/12). If the pressure is out with the high limit or low limit and the delay period has expired then the Plant Backup controller will enable the standby relay, placing the primary controller into standby and take control. When the primary pack controller is in standby and the pressure rises above the suction setpoint the first relay will turn on once the section on delay parameter expires (P-30/32). If the pressure remains above the suction setpoint and the section on delay expires for a second time then relay 2 will be turned on. As the pressure falls below the suction setpoint, including any diff, then the backup controller will begin to stage down, this results in relay 2 turning off after the parameter section off delay expires. If the pressure remains below the setpoint, including any diff and the section off delay expires then relay 1 will be turned off.

For a condenser section there is only a high limit with no delay. When the high limit is exceeded the controller takes control as above.

If the Inverter output is in use for a section then the Inverter output enable relay is energised and the analogue output is ramped up from 0 to 100% as soon as the pressure rises above the setpoint. Once the Inverter output reaches 100% then the section on delay timer will be initiated. Once the timer expires relay 2 is energised and the Inverter output resets to 0% where it then begins to ramp up to 100%. Once at 100% the section on delay timer is initiated again and once it expires relay 3 is energised and so forth. Once the pressure drops below setpoint, including any diff, the Inverter output begins to ramp down to 0%. Once at 0% the section off delay timer is initiated and when it expires relay 3 is turned off. The Inverter output then begins to ramp down from 100% and the process continues. The speed at which the Inverter output ramps up or down is governed by parameters P-71 and P-73.

Control Disabled

The plant backup controller is disabled and control returned to the primary controller when one of the following two conditions are met.

- i) The appropriate digital input Section 1 Reset or Section 2 Reset is activated and the pressure is within the predefined limits.

Or

- ii) The Plant Backup test feature has been enabled and the relevant conditions satisfied. Please see Test section for further details.

Test

When the Plant Backup controller is enabled and the primary pack/condenser controller is in standby the Plant Backup controller can be configured to test the primary controller after one hour. If this test is successful then the Plant Backup controller would bring the primary controller out of standby and return control to the primary controller.

Setting the Test Control parameter (P-50/51) to “On” will enable this feature. The Plant Backup controller will bring the primary pack/condenser controller out of standby and return control after 1 hour. At this point the Plant Backup controller will start checking for standby conditions. The test operation can be utilised again should the primary controller run normally for 12 hours after leaving standby.



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If standby conditions are encountered within 12 hours the Plant Backup controller will place the primary controller into standby and retake control. The test operation will not be repeated and the only way to return control to the primary controller is when the appropriate Section 1 Reset or Section 2 Reset is activated and the pressure is within the predefined limits. The test operation can be utilised again should once the reset input has been activated.

Viewing Inputs and Outputs

The controller display can be used to view the status of the inputs and outputs.

1. From the function menu, select "IO", press enter
2. You can now scroll through the IO tables as set out below. The tables you view will depend on the controller type configuration.

Input/Output Tables

Number	IO	Range	Units	LT Pack (Type 1)	HT Pack (Type 2)	HT & LT Pack (Type 3)	Condenser (Type 4)	Dual Condenser (Type 5)	LT Pack & Cond (Type 6)	HT Pack & Cond (Type 7)
I-01	Section 1 4-20mA or 0-10V	-3.4 to 180	Bar	✓	✓	✓	✓	✓	✓	✓
I-02	Section 2 4-20mA or 0-10V	-3.4 to 180	Bar			✓		✓	✓	✓
I-10	Section 1 Reset input	0 = Off, 1 = On	-	✓	✓	✓	✓	✓	✓	✓
I-11	Section 2 Reset input	0 = Off, 1 = On	-			✓		✓	✓	✓
O-01	Relay 1	0 = Off, 1 = On	-	✓	✓	✓	✓	✓	✓	✓
↓	↓									
O-12	Relay 12									
O-20	Section 1 Variable output	0 to 100	%	✓	✓	✓	✓	✓	✓	✓
O-21	Section 2 Variable output	0 to 100	%			✓		✓	✓	✓
S-01	Section 1 Control state	0 = Normal	-	✓	✓	✓	✓	✓	✓	✓
S-02	Section 2 Control state	0 = Normal	-			✓		✓	✓	✓



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Specification

Power requirements

Supply Voltage Range:	24 Vac $\pm 10\%$ or 24 Vdc $\pm 10\%$
Supply Frequency:	50 – 60 Hz $\pm 10\%$
Maximum supply current:	<1 Amp
Typical supply current:	<1 Amp
Class 2 Insulation:	No protective Earth is required. A functional earth can be connected if the equipment is located in an electrically noisy environment.

Note : The use of centre tapped to earth transformers is not allowed. This is to prevent damage to the transformer and/or controller.

The host equipment must provide adequate protection against contact to hazardous live parts.

RDM advise the use of a suitable external over-current protection device on the Mercury Plant Controller.

Warranty may be invalidated due to excess current being unlimited if there are no fuses/circuit breakers installed

General

Operating temperature range:	-10°C to +60°C
Operating Humidity:	80% maximum
Storage temperature range:	-20°C to +65°C
Environmental:	Indoor use at altitudes up to 2000m, Pollution Degree 1, Installation Category II.
Size:	Voltage fluctuations not to exceed $\pm 10\%$ of nominal voltage Mercury Plant Controller 270mm (L) x 115mm (W) x 50mm (H) Intuitive Plant Controller 280mm (L) x 122mm (W) x 67mm (H)
Weight:	Mercury Plant Controller 700 Grams Intuitive Plant Controller 750 Grams
Safety:	EN61010-1
EMC:	EN61326: 2006
Ventilation:	There is no requirement for forced cooling ventilation

Inputs

Digital Input type

The preferred option is a 0 volt return through a volt free relay or 24 Vac referenced to the supply voltage. If a 24Vac signal is being sourced from the Plant controller power supply then **do not** ground the Digital Input common rail, this is grounded internally.

4-20mA

4-20mA current loop, use the 12 Vdc output to feed the device.

Analogue Outputs

0 to 10 Volts DC or 0/4-20mA, Selected in the Front Panel Menu.
A 50mA fuse is recommended for each Analogue output.

The 4-20mA output will not operate correctly if the target device input impedance is > 75 Ω

The 0-10V output will not operate correctly if the target device input impedance is < 10K Ω

Relay Ratings, Mercury Plant Controller

5A/250 Vac/AC1 (Resistive load)
5A/30 Vdc (Resistive load)
2A/250 Vac $\cos\phi=0.3$ on N/O contact (Inductive Load)

Relay Ratings, Intuitive Plant Controller

10A/250 Vac/AC1 (Resistive load)
10A/30 Vdc (Resistive load)
5A/250 Vac $\cos\phi=0.4$

Fuse Ratings, Intuitive Plant Controller

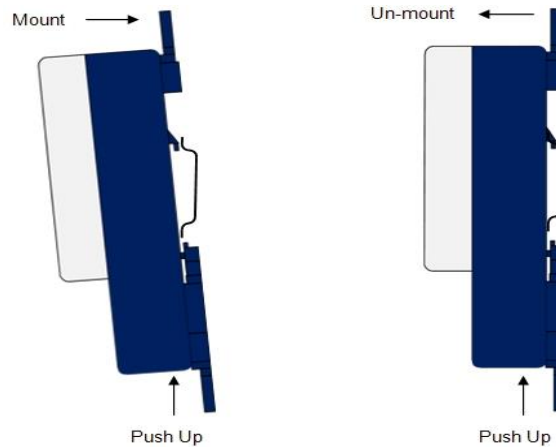
Relay Fuses 10A Antisurge HRC, 32 x 6.3mm
Supply Fuse 2A Antisurge HRC, 32 x 6.3mm



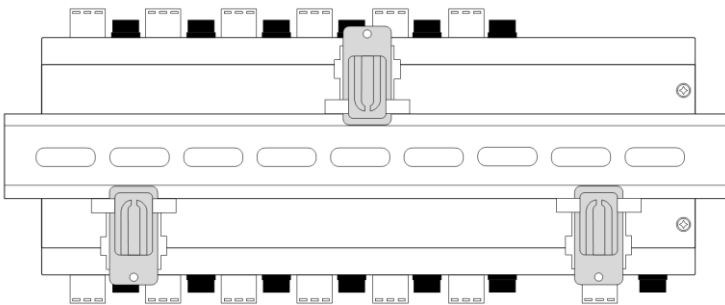
Ensure that all power is switched off before installing or maintaining this product

Installation

Mounting on to a DIN rail, Mercury Plant Controller



Mounting on to a DIN rail, Intuitive Plant Controller



Three clips fix the Intuitive Mercury securely to DIN rail. Pull each clip until it “clicks” to remove the controller. Each clip has a mounting hole to provide an alternative fixing mechanism to DIN mounting.

Clearances

The controller must have 10mm clearance above the top and 15mm clearance from the sides. Clearance at the front and rear is dependent on the site wiring.

There is no requirement for forced cooling ventilation

Cleaning

Do not wet the controller when cleaning. Clean the front by wiping with a slightly dampened lint free cloth.

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Revision History

Revision	Date	Changes
1.0B	24/02/2012	Current Issue
1.0C	24/01/2014	Universal IO connections corrected.
1.0D	17/04/2012	Analogue Out connections on PR0609 corrected.
1.0E	06/01/2014	Operating temperature range updated.
1.0F	07/04/2015	Allocation of standby relays description clarified further.
1.2	16/09/2016	Transducer range increased to 180 Bar.



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