



SmaRt
Panel Mount
PR0940



SmaRt
DIN Rail
Mount
PR0942

SmaRt Controller Installation & User Guide



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The SmaRt Controller Range From Resource Data Management

The SmaRt controller is a low cost controller primarily intended for use in refrigerated display cabinets. It is available in several hardware variants with one or two temperature probe inputs and one, two or three relay outputs (See table below). The first temperature probe is an air on evaporator probe and the second (if fitted) is user selectable between air off evaporator probe or defrost termination probe.

The first relay by default is cooling control, the second relay (if fitted) is fan control and the third relay (if fitted) being user selectable as defrost control, trim heater control or as an alarm relay. Relay 1 has changeover contacts with common, normally open and normally closed connections, relays 2 & 3 (if fitted) have a common and normally open connection only. All relays are fully mappable by the user so relay 1 can be used to switch a defrost heater for example (instead of cooling). All relays can also be inverted by the user so for example, the fan relay can be set to energise to switch on the fans or de energised to switch on the fans.

The controller has some features which are designed to help energy saving such as the “pulse trim heaters” parameter and “defrost skip” parameter, see parameter section for further details.

There are two enclosure types for the SmaRt controller, one that is in a DIN rail mountable enclosure and one that is panel mountable enclosure. There is also a network connection socket which allows the controller to communicate over IP with a suitably equipped Data Manager panel using the SmaRt network module and cable

The controller supports one temperature probe type which is NTC2K.

The SmaRt controller does not support electronic expansion valve control, stepper valve control and does not have a specific Coldroom configuration, for these applications please refer to the Mercury controller range.

Variants

Description	Part Number
SmaRt controller Panel mount, single probe, single relay	PR0940 1-1
SmaRt controller Panel mount, two probes, single relay	PR0940 2-1
SmaRt controller Panel mount, two probes, 3 relays	PR0940 2-3
SmaRt controller DIN Rail mount, single probe, single relay	PR0942 1-1
SmaRt controller DIN Rail mount, two probes, single relay	PR0942 2-1
SmaRt controller DIN Rail mount, two probes, 3 relays	PR0942 2-3

Controllers can also be supplied complete with temperature probes by adding P (Probes Included) to the end of the part number or NP (No Probes Included), for example PR0942 2-3 P

Configuration

The controller has six configuration type options built in which are selectable using the display buttons, this allows the controller to be quickly set up with minimal programming.

Type value	
1	Mobile (integral) HT
2	Mobile (integral) MT
3	Mobile (integral) LT
4	Remote piped case controller HT
5	Remote piped case controller MT
6	Remote piped case controller LT

The controllers are delivered pre-configured as type 1, mobile HT.

Compatible Network Interfaces

SmaRt Controllers are capable of connecting to a Data Manager panel to allow features such as data logging, alarm reporting and remote access, to do this a SmaRt network module and SmaRt communications cable is required before connecting the Data Manager’s IP network. The network module will be automatically detected on power up.

Description	Part Number
SmaRt network module, DIN Rail Mount (Single SmaRt controller to IP Interface)	PR0944 DIN
SmaRt network module, DIN Rail Mount (Dual SmaRt controller to IP Interface)	PR0944 DUALDIN
SmaRt communications cable (2m)*	PR0949
Din Rail Mount Single Modbus network module.	PR0945

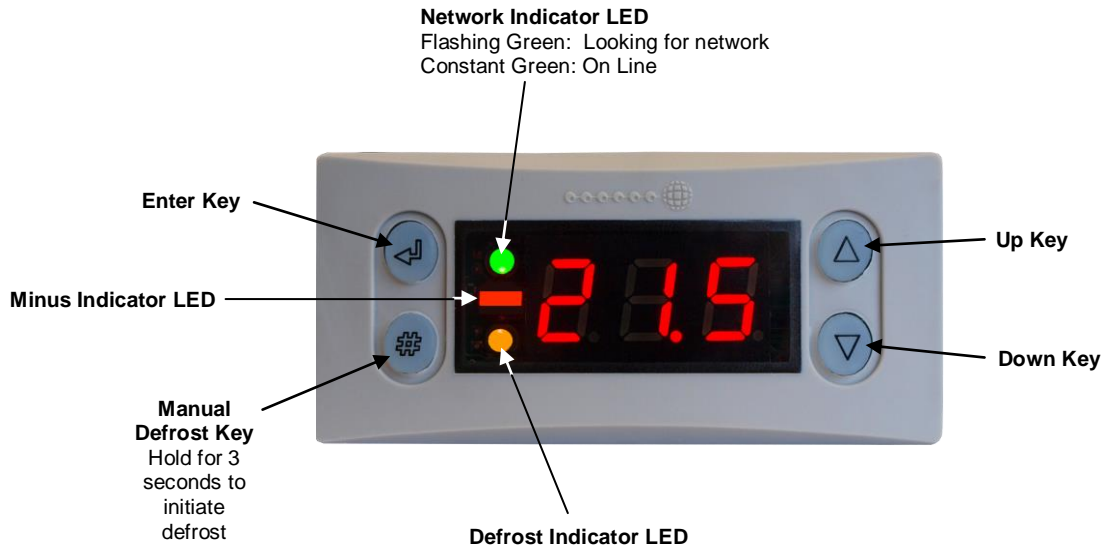
*This cable can be extended to a maximum of 5m using a suitable CAT5 extension lead with coupler.



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Front Display Features

The panel mount version is shown below but functionality is the same for the DIN rail mount version. When the controller is first powered up the display will show the type setting briefly, ty4 for example and then show controller status (REC for recovery for example) and then show the current display temperature.



Input and Output Allocation Tables

The table below shows inputs and outputs when the controller is at factory default settings, however probe 2 type can be selected by the user and all relay functionality can be changed.

TYPE	Integral CaseTypes 1, 2 & 3	Remote CaseTypes 3, 4 & 5
Probe 1	Air on Temperature	Air on Temperature
Probe 2 (If fitted)*	Air off Temperature or Defrost	Air off Temperature or Defrost
Relay 1	Compressor (connect to normally open)	Liquid Line Valve (connect to normally open)
Relay 2 (If fitted)	Fans	Fans
Relay 3 (If fitted)	Defrost (default), Trims or Alarm (user selectable)	Defrost (default), Trims or Alarm (user selectable)

* Note: If the controller is the single probe type (PR0940 1-1 or PR0942 1-1) then the parameter "Probe 2 Select" should be set to "Off", (Parameter P04 =0).



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Quick Start Menu Map

START

START

Controller will normally show control temperature. To enter the setup menu Press Enter and Down keys together, "Ent" will show on display

↓ ENT

INPUT OUTPUT MENU

Press Enter once and "IO" will show on display. Press Enter to select or Up to move to next menu

ENT ⇒

Press Up and Down keys to scroll through all inputs (I), outputs (O) and control state (S), press enter to display current value, enter again to go back. Press up or down to ESC and press enter to return to main menu.

↓ UP

PARAMETER MENU

Press Enter once and "Para" will show on display. Press Enter to select or Up to move to next menu.

ENT ⇒

Press Up and Down keys to scroll through all parameters P01 to P70, press enter to display current value, press up and down keys to adjust parameter and press enter to go back. Scroll up or down to ESC and press enter to return to main menu.

↓ UP

UNITS MENU

Press Enter once and "Unit" will show on display. Press Enter to select or Up to move to next menu.

ENT ⇒

Press Up and Down keys to select 0 (Centigrade) or 1 (Fahrenheit) and press enter to go back. Scroll up or down to ESC and press enter to return to main menu.

↓ UP

TYPE MENU

Press Enter once and "Type" will show on display. Press Enter to select or Up to move to the next menu.

ENT ⇒

Press Up and Down keys to select coldroom type 1 to 3 and press enter to go back. Scroll up or down to ESC and press enter to return to main menu. 1=High Temp, 2=Medium Temp, 3=Low Temp.

↓ UP

NETWORK MENU

Press Enter once and "net" will show on display. Press Enter to select or Up to move to next menu.

ENT ⇒

Display will show IPr if rotary address switches are set (IP address issued automatically) or IPL if rotary switches are set to 000 (Static IP address). Press Enter to show IP1 and Up and Down Keys to change value, repeat process for IP2 to IP4. If type is IPr then values are fixed.

↓ UP

SOFTWARE MENU

Press Enter once and "soft" will show on display. Press Enter to select or Up to move to next menu.

ENT ⇒

Shows current software version, press Enter key to go back

↓ UP

CONFIGURE NETWORK MENU

Press Enter once and "CnE" will show on display. Press Enter to select or Up to move to next menu.

ENT ⇒

Display will show "IP", this is default IP network type. Press up to scroll through "Ty-1" to "Ty-16", these are the different Modbus interface types, press Enter key to select the required type. Only Modbus network types 1 & 2 are used currently (Ty-1 and Ty-2)

↓ UP

ESCAPE

When displaying ESC, pressing the Enter key exits setup menu and returns to displaying current control temperature. Pressing the UP key returns to the top "IO" menu



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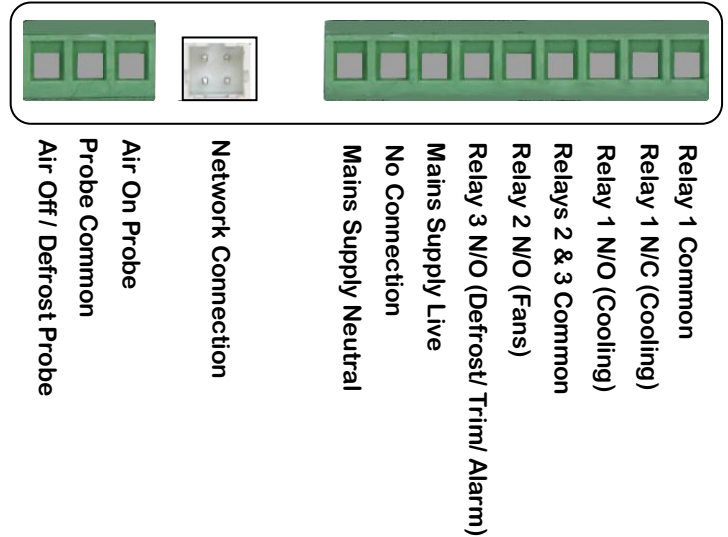
Connections

DIN Rail Mount Version



Panel Mount Version

On the panel mount version, Input and Output and network connections are made to the back of the controller, terminal screws are at the top of the controller.



Note:

The cable length of the temperature probe(s) supplied with the controller should not be extended due to an increased chance of electrical interference causing inaccurate probe readings.

If it is necessary to extend the cable length then the probe common connection should be connected to a local earth connection.

RDM cannot guarantee accuracy when extending the cable past the supplied length and it is the installers responsibility to check this if cables are extended and ground.

The diagrams above and to the left show the default connection details but as all relay functionality can be modified by the user the relay mapping and relay invert settings should be confirmed.

Relays 2 & 3 and probe 2 are optional depending on controller type.

As an example, by default relay 1 is the compressor or LLV relay however as relay 1 has a higher current rating than relays 2 & 3 then the user may decide to use relay 1 as the defrost relay and relay 3 as the compressor relay in which case the relay mapping value, which defaults to value 0, would be set to value 5.

See the relay mapping section for more details.



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Access to the controller can be achieved several ways

- Through the front mounted buttons
- Access using RDM Smart communicator software running on a PC using a Smart comms cable. This requires a serial RS232 port on the PC so a USB to RS232 adapter will usually be required as well.
- Through the RDM Data Manager.

Setup through front buttons



To enter setup mode, hold the Enter and Down buttons together, 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.



ENTER UP DOWN

Setup Function Menu

Display	Option	Explained in Paragraph	Display	Option	Explained in Paragraph
IO	View Inputs / Outputs and States	Input / output table	typ	Set controller type	Controller Type
PArA	Set/View Parameters	Set view parameters	net	Set/view network configuration	Network
Uni	Probe type and Celsius/Fahrenheit option	Set View Unit	sof	View software version	
rly	Set relay mapping	Relay Mapping	CnE	Configure Network	Network Selection
rIn	Invert Relays	Invert Relays	ESC	Exit Setup mode	

Recommended set-up method

If you are not connecting to a network and want to set up the controller through the buttons we recommend you use the following order from the function menu.

type. Set/view controller type

- From the function menu scroll to select type, press enter
- Use the up/down buttons to scroll through integral / static case types. (see [configuration table on page 3](#))
- Press enter.
- Scroll to select "ESC"
- Press enter

Controller type configuration is now set

PArA. Set/view parameters (This can be achieved at the network front end)

- From the function menu scroll to select PArA
- 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 setup mode. Selecting dFLt will reset all parameters back to the default values for the current type of controller.



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Unit. Set/view temperature unit

- From the function menu select uni, press enter to view current setting
- Press up and down to select between 0 for Celsius and 1 for Fahrenheit, press enter to go back to function menu.

Main set up is complete.

Relay operation can be modified if required using the following menus:

Rly Set/view relay mapping

As factory default relay 1 switches cooling (compressor or LLV), relay 2 switches fans and relay 3 switches the defrost heater or valve, this default setting is called relay map 0. There are 5 other relay maps available as shown in the table below, to select a different relay map:

- From the function menu select rly, press enter to view current setting
- Press up and down to select between relay maps 0 to 5.
- Press enter to go back to the function menu.

RELAY MAP	Relay 1 Function	Relay 2 Function	Relay 3 Function
0	Cooling	Fans	Defrost
1	Cooling	Defrost	Fans
2	Fans	Cooling	Defrost
3	Fans	Defrost	Cooling
4	Defrost	Cooling	Fans
5	Defrost	Fans	Cooling

Rln Set/view relay invert

As factory default all the relays operate as energising to switch on however it may be desirable to de energise a relay to switch on, for example the liquid line valve may require power applied to close it and power removed to open it so that in the event of a power or controller fail then the valve remains open. There are eight different relay invert settings available, default is 0 in which are all relays are energised to switch on.

- From the function menu select rln, press enter to view current setting
- Press up and down to select between relay invert maps 0 to 7.
- Press enter to go back to the function menu.

INVERT MAP	Relay 1 Function	Relay 2 Function	Relay 3 Function
0	Energise to switch on	Energise to switch on	Energise to switch on
1	Energise to switch Off	Energise to switch on	Energise to switch on
2	Energise to switch on	Energise to switch Off	Energise to switch on
3	Energise to switch Off	Energise to switch Off	Energise to switch on
4	Energise to switch on	Energise to switch on	Energise to switch Off
5	Energise to switch Off	Energise to switch on	Energise to switch Off
6	Energise to switch on	Energise to switch Off	Energise to switch Off
7	Energise to switch Off	Energise to switch Off	Energise to switch Off



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Parameter Tables,

Parameters P-10, compressor anti short cycle timer, and P-11, compressor maximum run time, only apply to types 1-3 Mobile (Integral) cabinets.

Number	Parameter	Range	Step	Units	Default Type 1 HT	Default Type 2 MT	Default Type 3 LT	Default Type 4 HT	Default Type 5 MT	Default Type 6 LT
P-01	Cut-in Temperature	-42 to 30 (-43.6 to 86)	0.1	Deg	12	0	-20	12	0	-20
P-02	Cut-in Diff	0 to 10 (0 to 18)	0.1	Deg	1.5	1.5	1.5	1.5	1.5	1.5
P-03	Control Weight	0 to 100	1	%	50	50	50	50	50	50
P-04	Probe 2 Select	0 = Off, 1 = Air Off, 2 = Defrost	1		1	1	1	1	1	1
P-05	Relay 3 Select	0 = Defrost, 1 = Trims, 2 = Alarm	1		0	0	0	0	0	0
P-10	Anti Short Cycle Timer (Integrals Only)	0 -128	1	min:sec	05:00	05:00	05:00	N/A	N/A	N/A
P-11	Maximum Run Time (Integrals Only)	0 -128	1	Mins	00:00	00:00	00:00	N/A	N/A	N/A
P-12	Control Fail On/Off	0 to 10	1	min:sec	05:00	05:00	05:00	05:00	05:00	05:00
P-13	Trim Level	0 to 100	1	%	100	100	100	100	100	100
P-15	Service	0 to 32	1	K hrs	0	0	0	0	0	0
P-29	Display Pin	0 to 999	1		0	0	0	0	0	0
P-30	OT/UT Alarm Delay	00 to 99	1	min:sec	20:00	20:00	20:00	20:00	20:00	20:00
P-31	Under Temperature Alarm	-42 to 30	0.1	Deg	4	-2	-30	4	-2	-30
P-32	Over Temperature Alarm	-42 to 30	0.1	Deg	18	5	-15	18	5	-15
P-40	Defrost Mode	0 = Local 1 = Remote	1		0	0	0	0	0	0
P-41	Defrost Frequency	0 – 99	1	Hours	4	4	4	4	4	4
P-42	Pump Down Time	0 – 99	1	min:sec	00:00	00:00	00:00	00:00	00:00	00:00
P-43	Defrost Time	0 – 99	1	min:sec	20:00	20:00	20:00	20:00	20:00	20:00
P-44	Defrost Skip	0 – 99	0	min:sec	00:00	00:00	00:00	00:00	00:00	00:00
P-45	Defrost Termination Temperature	-42 to 30	0.1	Deg	18.0	10	15	18.0	10	15
P-46	Drain Down Time	0 – 99	1	min:sec	02:00	02:00	02:00	02:00	02:00	02:00
P-47	Recovery Time	0 – 99	1	min:sec	30:00	30:00	30:00	30:00	30:00	30:00
P-60	Fans In Defrost	0 = Off, 1 = On	1		1	1	1	1	1	1
P-61	Fan Delay Mode	0 = Time, 1 = Temp	1		0	0	0	0	0	0
P-62	Fan Delay Time	0 – 99	1	min:sec	03:00	03:00	03:00	03:00	03:00	03:00
P-63	Fan Delay Temp	-42 to 30	0.1	Deg	15	5	-5	15	5	-5
P-64	Trims In Defrost	0 = Off, 1 = On	1		0	0	0	0	0	0



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Parameter Descriptions

Number	Parameter	Description
P-01	Cut-in Temperature	Temperature at which the LLV or compressor will switch on.
P-02	Cut-in Diff	Differential temperature below the cut-in temperature. The LLV or lead compressor switches off when below this temperature
P-03	Control Weight	Percentage of the Air-On temperature that is used to calculate the control temp. The remaining percentage will be used on the Air-Off temperature Example, P-03 set to 30%, Control temp = 30% Air-on + 70% Air-off
P-04	Probe 2 Select	Allows probe 2 to be selected as an air off probe or defrost termination probe.
P-05	Relay 3 Select	Allows relay 3 to be used as defrost (default), trim control or alarm.
P-10	Anti Short Cycle Timer (Integrals Only)	Limits the time between compressor starts
P-11	Maximum Run Time (Integrals Only)	When the compressor has been running for this length of time within the dead band (control temp minus diff) then the compressor is turned off for the anti short cycle period. This feature is to rest the compressor and also to provide energy saving.
P-12	Control Fail On/Off	If the controller cannot control due to probe failure then the compressor will cycle off and on within a 10 minute period, for example, if this parameter is set for 3 minutes then the compressor will run for 3 minutes and stop for 7 minutes.
P-13	Trim Level	Sets a percentage level, over a 5-minute period, to pulse the trim heater relay off/on for example if set to 50% heaters will be on for 2.5 minutes and off for 2.5 minutes. Note the trims are turned off when an over temperature alarm occurs.
P-15	Service	If "CompRun Time" exceeds "Service" time" an alarm is generated to the Data Manager, If networked and controller will display the message "SEr". The alarm will be generated again after 24hours. To reset, the "Service " time parameter has be set to 0. This can be password protected using the "Display Pin" code
P-29	Display Pin	Allows the user to enter a 3 digit PIN number which is required to be entered before changing any parameters using the controller display buttons. This should be used with care as it requires a PC or Data Manager connection to reset.
P-30	OT/UT Alarm Delay	Delay for the over and under-temperature alarms
P-31	Under Temperature Alarm	Under temperature alarm set point. This alarm uses the control temperature.
P-32	Over Temperature Alarm	Over temperature alarm set point. This alarm uses the air-off temperature probe if fitted, otherwise the air on probe is used.
P-40	Defrost Mode	When set to local the controller uses it's internal timer, if set to remote then it uses the Defrost timer on the Data Manager via the network connection.
P-41	Defrost Frequency	The number of hours between defrosts.
P-42	Pump Down Time	Time period before the defrost min period to allow for a pump down
P-43	Defrost Time	Length of defrost cycle if termination temperature is not reached.
P-44	Defrost Skip	This feature allows the controller to skip defrosts. If the current defrost terminates on temperature then the controller will skip the next scheduled defrost providing the previous defrost terminated before the defrost skip time. Operates only when the controller is set to local defrost scheduling. Set to 0 if feature is not required
P-45	Defrost Termination Temperature	The defrost will terminate and defrost relay will switch off when this temperature is reached, this temperature is measured by either probe 2 (the defrost probe or air off probe.) or probe 1 if only using one probe
P-46	Drain Down Time	A period after defrost to allow the draining of any surplus water
P-47	Recovery Time	The LLV or compressor relay is switched on at the start of this period to allow the temperature to recover to the normal operating point. This period also inhibits the OT alarm. Note that if the air-off temperature (or air on temperature if no air off probe fitted) is still above the OT alarm setpoint when this period expires, an immediate OT alarm occurs; there is not a further alarm delay.
P-60	Fans In Defrost	Allows fans to run or not during defrost, normally set to off in full glass door cabinets or coldrooms.
P-61	Fan Delay Mode	This parameter allows the fans start after a drain-down period to be delayed, either by time (P-62) or when the temperature point (P-63) is reached. This parameter uses the defrost probe or air off temperature (probe 2)
P-62	Fan Delay Time	Fan delay time after defrost if P-61 set to time.
P-63	Fan Delay Temp	Holds the fans off after defrost until this temperature is reached if P-61 set to temperature.
P-64	Trims In Defrost	Allows the trim heaters to operate in defrost or not.
dFLt	Restore default values	Restores all of the parameters to their default values



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Relay and screen states during defrost

State:	Pump Down	Defrost	Drain Down	Fan Delay	Recovery
Screen:	DEF	DEF	DEF	DEF	REC
Def LED:	On	On	Off	Off	Off
RLY 1 LLV or Compressor	Off	Off	Off	On	On
RLY 3 Trim on in defrost (If fitted)	On	On	On	On	On
RLY 3 Trim off in defrost (If fitted)	Off	Off	Off	Off	On
RLY 3 Defrost Relay (If fitted)	Off	On (until termination temperature)	Off	Off	Off
RLY 2 Fans (On in DF) (If fitted)	On	On	On	Off	On
RLY 2 Fans (Off in DF) (If fitted)	On	Off	Off	Off	On

CnE

This section allows for the setup of either IP network (default) or Modbus RS485, this will affect the menus that are shown in Net menu in the next section.

When entering the CnEt menu, IP will be shown on the display, this is the default setting for communication with an IP network using Cat 5 cabling. Pressing the up and down keys selects 1 of 16 Modbus RS485 network configurations, the display will show Ty-1 to Ty-16, at present only types Ty-1 and Ty-2 are used, press the enter key to select the configuration required.

Ty-1 = Modbus 9600 Baud Rate, 8 Bit, No Parity, 1 Stop Bit.

Ty-2 = Modbus 9600 Baud Rate, 8 Bit, No Parity, 2 Stop Bits

Network Configuration

The final section to setup is the network address. In all instances, this must be done before the controller is plugged into the site network. The controllers have an auto-initialise function, which will automatically log the device onto the site network. If the wrong address has been entered onto the network, you will have to reset the controller address by setting the address to 00-0, and then re-enter the correct address. (You may have to deregister the wrong address from the home system as well).

When logging a SmaRt controller onto a Data Manager IP network you must first connect the controller to the SmaRt communications module.

Enter the controller function menu by pressing the enter and down keys together and then pressing the enter key once, IO will show on the display. Press the up and down keys to reach the net menu and press enter, the display will show one of two options IP-L or IP-r.

IP-L allows you to fix an IP address into the controller, which you would use when you are connecting the controllers onto a Data Manager front end using a static IP address.

IP-r allows you to give each controller on the system a unique number. This number is then allocated a dynamic IP address by the Data Manager's DHCP server.

IP-L

To configure the communication module for IP-L, set all three rotary switches to zero. The module should then be connected to the controller.

1. nEt. From the function menu you can now select nEt
 - Press enter and the display will show "IP-L", press enter
 - You can now set the address using the table below

Display	Option
IP-1	IP Address byte 1
IP-2	IP Address byte 2
IP-3	IP Address byte 3
IP-4	IP Address byte 4
nL	Network Mask Length
gt-1	Gateway Address byte 1
gt-2	Gateway Address byte 2
gt-3	Gateway Address byte 3
gt-4	Gateway Address byte 4
ESC	Exit network menu. N.B. this option must be selected to save any changes made in this menu



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

IP-r

To configure the communication module for IP-r, set the three rotary switches to give each controller a unique identifier. The module should then be connected to the controller and the network. nEt. From the function menu you can now select nEt

- Press enter and the display will show "IP-r", press enter
- You can now view only the address given by the DHCP server

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

NOTE: The SmaRt controller will only communicate automatically with Data Managers with firmware version V2.2 or above, older Data Managers will require a software upgrade patch installed, please contact RDM technical support for more details.

Viewing

Apart from setting up the controller, you can also view the status of the inputs and outputs and controller states. From the function menu, select "I/O", press enter. You can now scroll through the IO table as set out below. Inputs and outputs that do not apply to a particular controller type will be greyed out.

Input / Output Table

Number	IO	Range* °C (°F)	Step	Units
I-01	Control Temp	-42 to 128 (-43.6 to 262)	0.1	Deg
I-02	Air On Probe	-42 to 128 (-43.6 to 262)	0.1	Deg
I-03	Air on / Defrost Probe	-49 to 128 (-56.2 to 262)	0.1	Deg
O-01	Liquid Line/Compressor	0 (Off), 1 (On)		
O-02	Fans	0 (Off), 1 (On)		
O-03	Defrost	0 (Off), 1 (On)		
O-04	Trims	0 (Off), 1 (On)		
O-05	Setpoint Offset	-49 to 128	1.0	Deg
O-06	Last Defrost Type	0 (None), 1 (Display), 2 (Timed), 3 (Missed),4 (Network), 5 (Skipped)	1	
O-07	Last Defrost Length	00:00 to 03:00	00:01	hh:mm
O-8	Last Def. Ctrl Temp.	-42 to 128 (-43.6 to 262)	0.1	Deg
O-20	CompRun	0 to 320	1	K Hrs
S-01	Control State	0 (Stabilise),1 (Normal), 2 (Defrost), 3 (Drain Down), 4 (Fan Delay), 5 (Recovery), 6 (OT Alarm), 7 (UT Alarm), 8 (Pump Down)	1	

Messages

The following alarms and messages can appear on the SmaRt controller display.

Display Message	System status
Prb Flt	Both probes are faulty
Flt	One Probe is Faulty
rEC	Control State in Recovery
dEF	Control Sate in Defrost
AL	Control State in Alarm



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Network Alarms

The table below shows the text and associated type number that is sent to the system “front end”. The type number is normally used to provide different alarm actions.

Alarm text	Type # (index)
Case over temperature	4
Case under temperature	5
Probe 1 or 2 Faulty	6
Service Time	6

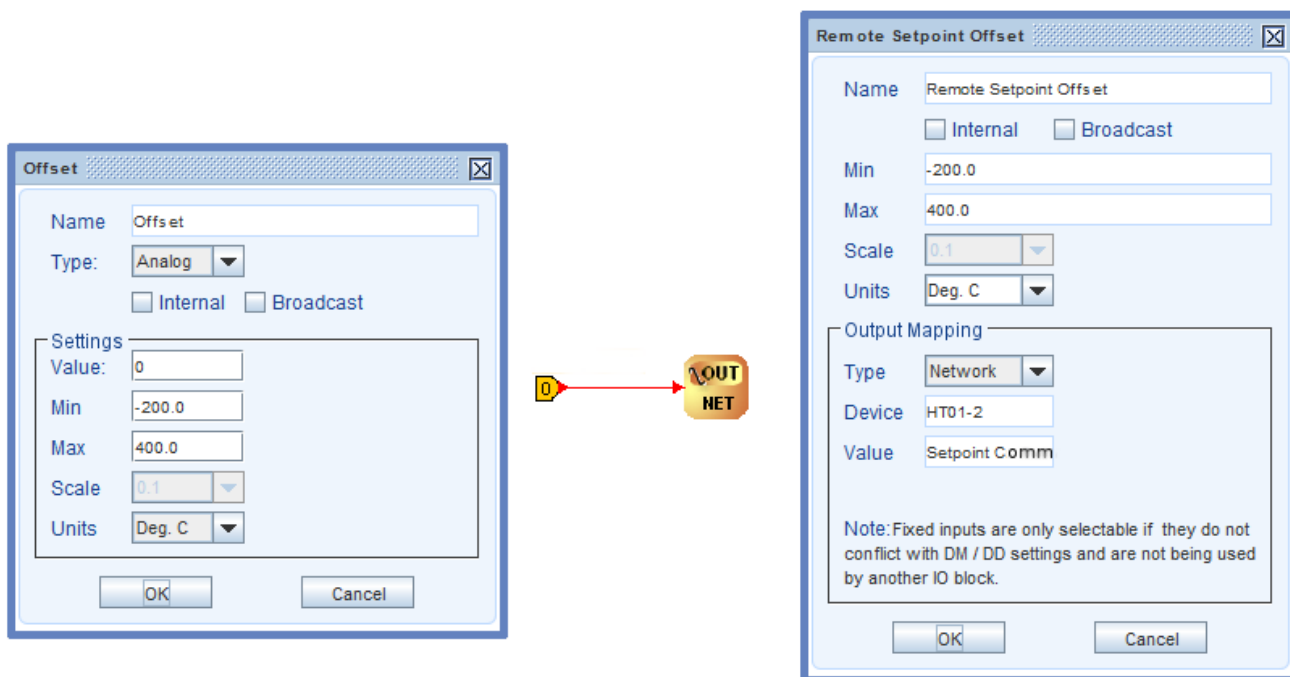
Remote Commands

The following command can be used by a Data Builder program: -

Command	Value to send	Description	Conditions
Setpoint Command	+/-18	Is added to or subtracted from the setpoint	
Defrost Command	1	Initiates a defrost cycle	Defrost mode: remote
Trim Command	0 to 100%	Sets the trim level to this value (Trim period is 5 minutes)	Relay 3 mode: Trim Heater
Case Off Command	5 0	Sets the controller to Case Off Restores the controller from Case Off to Normal	

Use an “Analogue Out” block configured to the controller name and in the value field type Setpoint Command. Use a “Setting block” as the input to the “Analogue Out” block to send the Value.

In the example below, whatever value is set in the setting block, the control setpoint will be changed by that amount on HT01-2



Network Interfaces

There are two DIN rail mounted IP interfaces available (PR0944 DIN and PR944 DUALDIN), these allow the controller to be connected to a Data Manager IP network. Both variants are powered by a mains (100-240Vac) to 5Vdc DIN rail mounted power supply, which is included. The PR0944 DIN provides a single CAT5 socket for connection to the IP network whereas the PR944 DUALDIN provides two CAT5 sockets which allows multiple interfaces to be connected in series, reducing the need for an IP network switch. The DIN rail mounted RS485 Modbus interface (PR0945 DIN), allows the controller to be connected to a suitable Modbus compatible front end, such as a Data Manager.



Power Supply for PR0944



PR0944 DIN

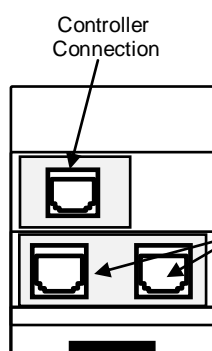


PR0944 DUALDIN

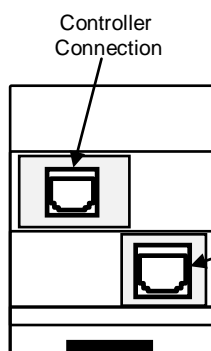


PR0945

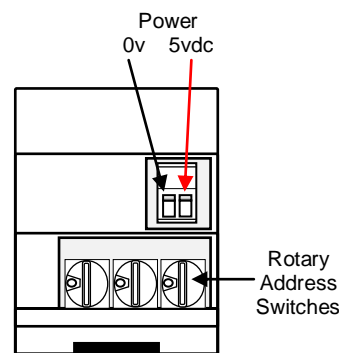
PR0944 Connections



PR0944 DUALDIN Front

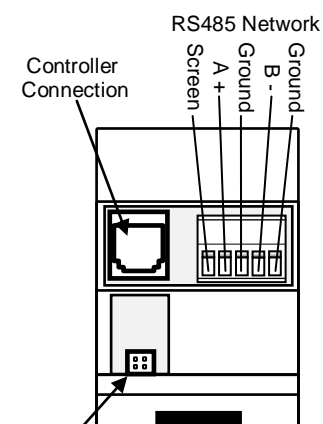


PR0944 DIN Front

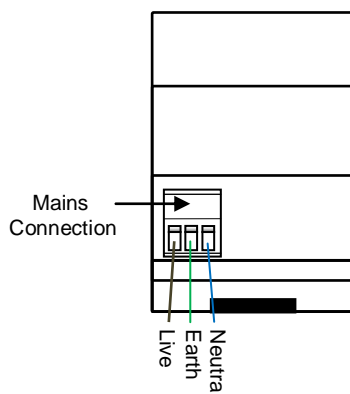


PR0944 DUAL / DUALDIN Back

PR0945 Connections



PR0945 Front



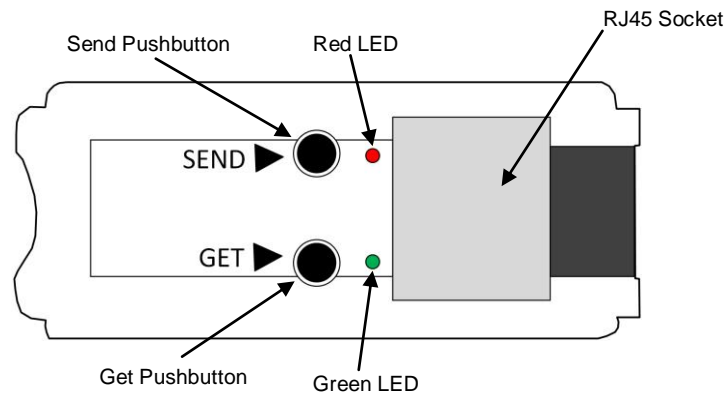
PR0945 Back

Note: The Smart controller is compatible with the PR0018 Mercury Hub however it should be noted that the maximum cable length from controller to hub is 5m.



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Using the Smart Caesium Programming Adapter



The Smart Caesium Programming adapter is a device designed to copy and store controller parameters from Smart controllers. These parameters can then be downloaded into similar controllers allowing a quick method of setting parameters in a batch of controllers whose settings have to be identical. (**Note** : This method is for same controller types only). The parameters can be uploaded to the Programming Module then locked in the module to prevent accidentally overwriting the uploaded parameters. The Module has an RJ45 socket to connect to the Smart network lead, two buttons for uploading, downloading, locking and unlocking parameters and two LEDs (One Green and one Red) to indicate the status or operation being carried out.

Connect the module to the network cable of the controller whose parameters have to be uploaded / downloaded :

The Green LED should be on steady. The Red LED should be off if the Caesium is blank and flashing at 1 second intervals if it has parameters already stored in it.

Note : The Red LED flashing at 2 second intervals indicates the module has parameters loaded and locked in Module.

To Upload parameters from Controller to Module :

Press the Upload (Get from Controller) button :

Green LED should now flash at 1 second intervals. Red LED should still be flashing – Release button.

Press Upload button again while Green LED is flashing. When the Red LED stays on steady – Release button.

Red LED stays on steady and Green LED flashes faster, after a short time both Red and Green LEDs flash simultaneously 4 times.

Parameters are now uploaded to module. Unplug module or lock parameters then unplug module.

Note : If parameters are locked in module and upload button is pressed the Red LED will still flash, but the Green LED will stay on steady indicating that parameters are locked and new parameters **cannot** be uploaded.

To Download parameters from Module to Controller :

Press the Download (Send to Controller) button :

Green LED should now flash at 1 second intervals. Red LED should still be flashing – Release button.

Press Download button again while Green LED is flashing. When the Red LED stays on steady – Release button.

Red LED stays on steady and Green LED flashes faster, after a short time both Red and Green LEDs flash simultaneously 4 times.

Note : LEDs **not** flashing 4 times indicates user is trying to download parameters to a controller with a different type, and parameters will **not** be sent to controller.

Parameters are now Downloaded to Controller. Unplug module.

To Lock Parameters in Module :

Press and hold both buttons at the same time.

Both LEDs will go off then flash simultaneously 3 times then go off again – Release both buttons at this point. Green LED will now come on steady again and Red LED will flash at **2 second** intervals.

Parameters are now locked in Module.

To Unlock Parameters :

Press and hold both buttons at the same time.

Both LEDs will go off then flash simultaneously 3 times then go off again – Release both buttons at this point. Green LED will now come on steady again and Red LED will flash at **1 second** intervals again.

Parameters are now unlocked.

Note : Do not unplug module from controller while Green LED is flashing as parameter info is being transferred while LED is flashing.



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Specification

	SmaRt Controller PR0940, PR0942
Power requirements	
Supply Voltage Range	90 – 240 Vac ±10%
Supply Frequency	50 – 60 Hz
Maximum supply current	1 Amp
Typical supply current	0.1 Amp
General	
Operating temperature range	0°C to +50°C
Storage temperature range	-20°C to +65°C
Environmental	Indoor use at altitudes up to 2000m, pollution degree 2, installation category II. Voltage fluctuations not to exceed ±10% of nominal voltage.
Size, Panel Mount Version	78mm (W) x 36mm (H) x 75mm (D)
Size, DIN Rail Mount Version	52mm (W) x 70mm (H) x 120mm (D)
Approx Weight	DIN Rail Mount 200 grams, Panel mount 140 grams.
Panel Cut Out, Panel Mount Version	29 x 71mm
Safety	EN61010
EMC	EN61326; 2013
Other Approvals	FCC, RCM
Ventilation	There is no requirement for forced cooling ventilation
Class 2 Insulation	No protective Earth is required and none should be fitted
Supply Fuse	The host equipment must provide a suitable external over-current protection device such as: - Fuse: 1A 240 Vac Antisurge (T) HRC conforming to IEC 60127
Or MCB	1A, 240 VAC Type C conforming to BS EN 60898
Relay Specification	
Relay 1, Changeover	
Max current	8A Resistive (CosØ = 1) 5A Inductive (CosØ = 0.4)
Max voltage	250Vac, 30V dc
Relays 2&3 (If fitted), Single Pole, shared common	
Max current	3A Resistive (CosØ = 1) 2A Inductive (CosØ = 0.4)
Max voltage	250Vac, 30V dc
DIN Rail Power Supply for PR0944	
	Input: 100-240 VAC, 0.88A Maximum Output: 5 VDC, 2.4A Maximum

Fixing, panel mount version

The controller is fixed by sliding the 2 plastic retaining clips up to rear of the panel. These clips have a ratchet action and can be removed by holding in the clip sides and sliding back.

There is no requirement for forced cooling ventilation

Cleaning

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

Disclaimer

The specifications of the product detailed in this document may change without notice. RDM Ltd shall not be liable for errors or omissions, for incidental or consequential damages, directly or indirectly, in connection with the furnishing, performance or misuse of this product or document.



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Appendix 1: Smart Controller Modbus® register address table

	Register	Name	Min	Max	Unit	Register Type	Item Type					
Inputs & Outputs	0	Control temp.	-49 (-56.2)	60 (140)	C (F)	3 – Holding	Word	÷ 10	Invert	Extend		
	1	Air on Probe	-49 (-56.2)	40 (104)	C (F)	3 - Holding	Word	÷ 10	Invert	Extend		
	2	Air off/Def Probe	-49 (-56.2)	40 (104)	C (F)	3 - Holding	Word	÷ 10	Invert	Extend		
	3	Liq. Line Valve	0 = Off				3 - Holding	Word		Invert		
			1 = On									
	4	Case Fans	0 = Off									
			1 = On									
	5	Defrost Control	0 = Off									
			1 = On									
	6	Trims	0 = Off									
1 = On												
7	Setpoint Offset	-18 (-56.2)	18 (104)				C (F)	3 - Holding	Word	÷ 10	Invert	Extend
8	Last Def. Type	0 = None							3 - Holding	Word		
		1 = Display										
		2 = Timed										
		3 = Missed										
		4 = Network										
		5 = Skipped										
9	Last Def. Length	0	5940	min:sec	3 - Holding	Word	x 60	Invert				
10	Last Def. Temp.	-49 (-56.2)	60 (140)	C (F)	3 - Holding	Word	÷ 10	Invert				
States	48	Control State	0 = Stabilise				3 - Holding	Word		Invert		
			1 = Normal									
			2 = Defrost									
			3 = Drain Down									
			4 = Fan Delay									
			5 = Recovery									
			6 = Alarm									
			7 = Case Off									
			8 = Pump Down									
Commands	36	Defrost Command	0 = Normal				3 - Holding	Word		Invert		
			1 = Defrost									
			2 = ElecDf									
			3 = DefTerm									
			4 = Standby									
			5 = CaseOff									
			6 = FansOnly									
37	Trim Command	0	100	%	3 - Holding	Word	x 1	Invert				
38	Setpoint Command	-18 (-18)	18 (18)	C (F)	3 - Holding	Word	÷ 10	Invert	Extend			



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39	Case Off Command	0 = Normal	3 - Holding	Word	x 1	Invert
		1 = Defrost				
		2 = ElecDf				
		3 = DefTerm				
		4 = Standby				
		5 = CaseOff				
		6 = Fans Only				

	Register	Name	Min	Max	Unit	Register Type	Item Type
Alarms	1	Missed Defrost				1 – Read Coils	Coil
	2	Probe 1 Faulty					
	3	Probe 2 Faulty					
	4	Case over temperature					
	5	Case under temperature					

Note: - The parameters are 'Read/Write' so in all cases the 'Read' type is 3 – Holding and the 'Write' type is 6 – Write.

	Register	Name	Min	Max	Unit	Register Type	Item Type	
Parameters	11	Cut-in temp	-49 (-56.2)	60 (140)	C (F)	See note above	Word ÷ 10 Invert Extend	
	12	Cut-in diff.	-49 (-56.2)	60 (140)	C (F)		Word ÷ 10 Invert Extend	
	13	Control weight	0	100	%		Word x 1 Invert Extend	
	14	Prb 2 Select	0 = Air					Word x 1 Invert
			1 = Def					
	15	Relay 3 Mode	0 = Lght					Word x 1 Invert
			1 = Def					
			2 = Alm					
	16	Ctrl Fail On/Off	0	5940	mm:ss		Word x 60 Invert	
	17	Trim Level	0	100	%		Word x 1 Invert	
	18	Display Pin	0	999			Word x 1 Invert	
	19	OT/UT alarm dly	0	5940	mm:ss		Word x 60 Invert	
	20	Under Temp Alm	-49 (-56.2)	60 (140)	C (F)		Word ÷ 10 Invert	
	21	Over Temp Alm	-49 (-56.2)	60 (140)	C (F)		Word ÷ 10 Invert	
	22	Defrost Mode	0 = Local					Word x 1 Invert
			1 = Remote					
	23	Defrost Frequency	0	120	hrs		Word x1 Invert	
	24	Pump Down Time	0	5940	min:sec		Word x 60 Invert	
	25	Defrost Time	0	5940	min:sec		Word x 60 Invert	
	26	Defrost Skip	0	5940	min:sec		Word x 60 Invert	
27	Def. term. temp	-49 (-56.2)	60 (140)	C (F)	Word ÷ 10 Invert			
28	Drain down time	0	5940	min:sec	Word x 60 Invert			
29	Recovery Time	0	5940	min:sec	Word x 60 Invert			
30	Fans in Def	0 = Off				Word x 1 Invert		
		1 = On						



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31	Fan Delay Mode	0 = Time			See note above	Word	x 1	Invert
		1 = Temp				Word	x 60	Invert
32	Fan Delay Time	0	5940	min:sec		Word	x 60	Invert
33	Fan Delay Temp	-49 (-56.2)	60 (140)	C (F)		Word	÷ 10	Invert
34	Trims in Def.	0 = Off			Word	x 1	Invert	

Revision History

Revision	Date	Changes
1.0	07/08/2015	First release
1.0a	28/08/2015	Caesium section added
1.1	08/10/2015	Compressor run time output and Service time parameter added.
1.2	02/12/2015	Part numbers for 1 & 2 relay and single probe versions added.
1.2a	03/12/2015	IP Module part numbers added, comms. cable length added.
1.2b	17/03/2015	Note on extending probe cable length added.
1.4	21/07/2016	Def Term. On Probe 1, if only 1 probe used. Added Modbus support.
1.4a	14/02/2017	Added ECA approval
1.4b	30/03/2017	Network Module details added.
1.5	15/09/2017	Network cable lead can now be extended to 5m, TDB defrost terminate command removed.
1.5a	27/09/2017	Note about single probe use added to page 4.
1.5b	04/10/2019	Modbus Table updated.



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