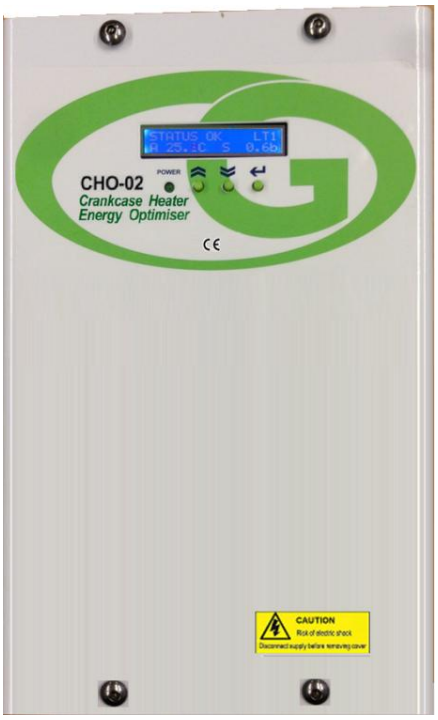
CHO-02

Crankcase Heater Energy Optimiser

For Reciprocating & Scroll Compressors

HANDBOOK



Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

Contents

Guardian Controls International Ltd. Email sales@guardian-controls.com
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN. Tel +44(0)1270760599 Fax +44(0)1270766804

CHO-02 Crankcase Heater Energy Optimiser

This optimiser provides relay inhibit contacts for the crankcase heaters on up to 10 digital scroll or piston compressors plus inhibit contacts for the plant room ventilation fans.

The control uses the measurement of pack suction pressure, suction line temperature and pack enclosure ambient temperature to determine whether it is safe to inhibit the compressor crankcase heater power.
The controller can save further energy by switching off the pack enclosure ventilation fans if required.

Significant energy savings can be made by inhibiting compressor crankcase heaters when it is safe to do so.

Crankcase Heaters

The reason for fitting crankcase heaters on supermarket packs is to prevent migration of liquid refrigerant to the compressor crankcase in order to protect the compressor when it is not running and its location is cooler than the evaporating condition. The heaters evaporate liquid refrigerant trapped in the oil when the compressor is operating in ambient temperatures lower than the evaporator temperatures such as in outdoor units or cold plant rooms.

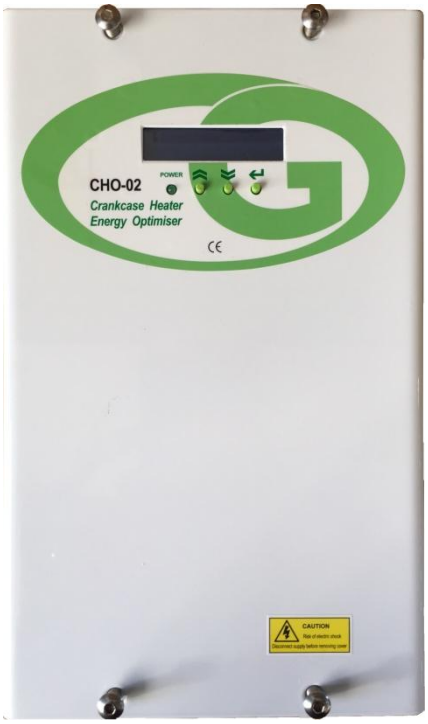
Most compressors are fitted with these crankcase heaters when the compressor is manufactured. These heaters are normally operated during the off cycle and usually are not thermostatically controlled.

Refrigerant oil mixtures in the compressor begin to form when the compressor starts and the oil charge is pumped out of the compressor. This effect is called *oil slugging*. Slugging can cause broken valves, damaged pistons and broken head gaskets.
Flooded starts occur when the compressor picks up refrigerant mixed with oil and feeds it into the cylinders and bearings. There may be severe damage as a result.

The heating coil keeps the crankcase coil warmer than the system temperature. This forces the refrigerant to remain in the condenser, evaporator or accumulator.

CHO-02 fitted on HT Pack

CHO-02 Optimiser Front View



Average Annual Energy Savings of 75%

- Straight forward retrofit to existing packs as part of energy saving initiatives
- Increases pack efficiency from day one when fitted to new packs
- Vital oil slugging and flood back safeguards
- Compatible with existing control equipment
- Simple set up and configuration
- In built data logging; 28 day rolling log and cumulative totals

Features

Suitable for reciprocating or scroll compressor packs

Up to 10 compressors & 1 ventilation fan per pack

LCD display with configuration buttons

Inbuilt data logging to verify savings

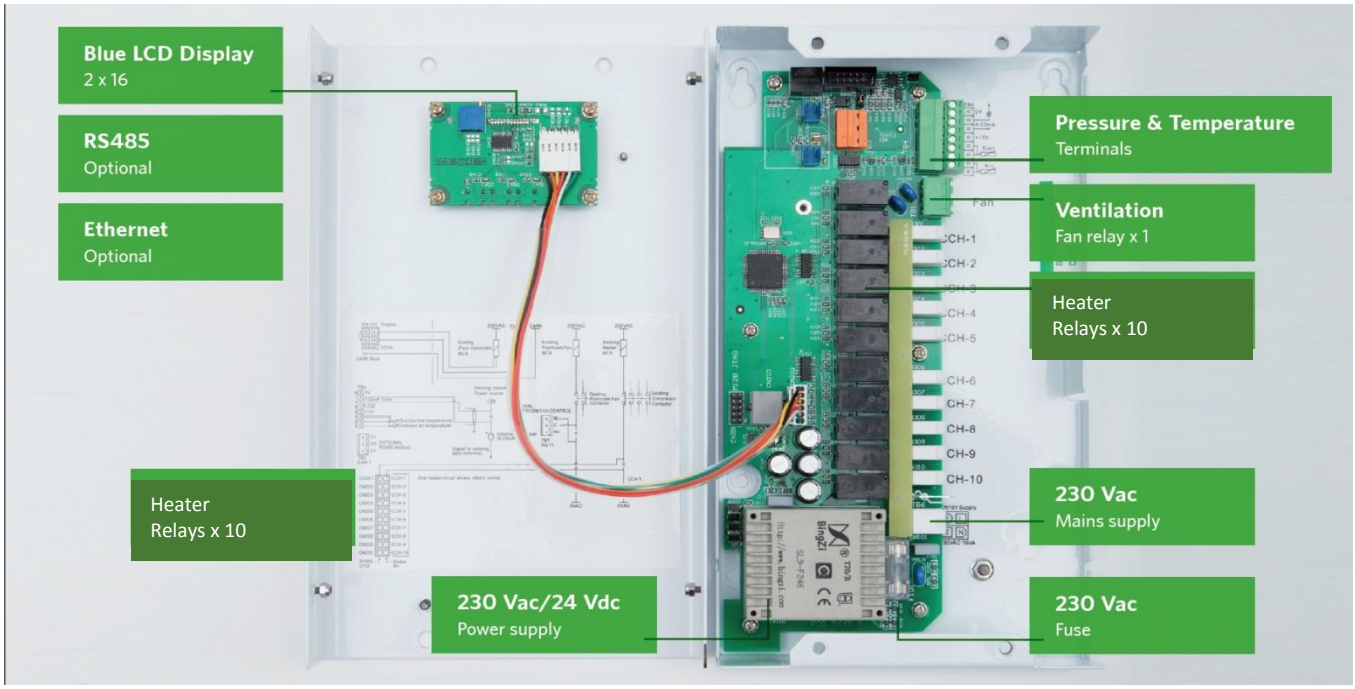
Slim vertical fitting enclosure

Kit includes all necessary probes, cables and glands for installation

Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

CHO-02 Optimiser Hardware

Interior view



CHO-02 Specification

	Quantity	Description	Application	
Power		Rating: 230Vac 50/60Hz 10VA Fuse : 250Vac, 3.15A, Time-Lag	Supply to be derived from panel MCB (6A)	Page 6
Environment	Operation Storage	0~55℃ / <85% RH/non condensing -40~70℃/ <90% RH/non condensing		
Dimensions		W 150mm H 250mm D 40 mm		
Mounting	IP22	End of pack panel or Wall mounting		Page 4
Analog Inputs	1 1 1 1	-1 to 6 barg 4-20ma OR -1 to 6 barg 0 to 5vdc -40℃ to 50℃ 2K252 NTC Thermistor -40℃ to 50℃ 2K252 NTC Thermistor	Suction Pressure transducer mA OR Voltage Suction Pressure alternative Suction Temperature ˚C Ambient Temperature ˚C	Page 9 9 9
Digital Inputs	DI 1-10	230vac inputs from N/C contact of Relays	Heater demand inputs CH1-10	page8
Relay Outputs	RO 1-10 RO 11	230 Vac N/C 3A 230 Vac C/O 3A	Heater inhibit Outputs CH1-10 Ventilation Fan inhibit outputs	page8
Display Interface	1 3 1	2 x 16 character, Blue, LCD Display Buttons for ⏬ ⏫ ↵ Power indicator LED	Display of status,calcuated and measured values, accumulators, setup of limits and history data	Page11
Refrigerants		R404A, R407A, R407F, R422D, R744		
Optional Communication	1x RS485 1x Ethernet	Modbus NTC RS485 19200 baud 8n2 Modbus TCP/IP	Fitting RS485 PCB or IPM-04 Ethernet unit is covered in CHO Communication Handbook	Page18

Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

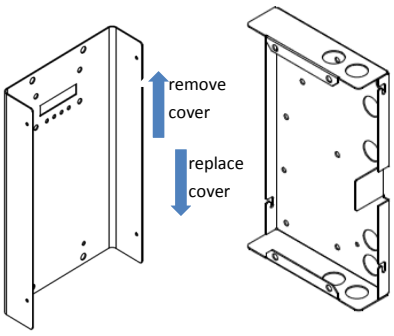
CHO-02 Panel Fitting Kit

Stock No	Qty	Description		
5300036	1	**CHO Panel Fitting Kit**		
Stock No	Qty	Description		
0100701	20	White 0.75mm Boot Lace Terminal	Bag 1	All cable connections except
0100702	10	Orange 0.5mm Boot Lace Terminal	Bag 1	10 heater cable orange wires
0100XXX	2	Dual 0.5mm Boot lace terminal		Double wire terminal
0100703	10	Red Butt Splice Terminal	Bag 1	Heater cables
0100704	2	M20 Grey Cable Gland	Bag 2	Temperature probes
0100705	4	360mm x 4.83mm Black Cable Tie	Bag 2	As required
0100707	6	4.8x25mm Self Drill Screw	Bag 3	Fix to Electrical Panel
0100XXX	4	http://www.plastic-caps.co.uk/thread/protectors.html	Bag 3	Fix to Electrical Panel
0100708	5	M5 x 16 A2 S/S Socket Screw	Bag 4	cover
0100709	4x35mm	Black 3:1 6/2mm HeatShrink 4 X 35mm per unit	Bag 5	Pipe Probe
0100710	2x100mm	Black PVC Sleeve 2 x 100 mm per unit	Bag 5	Pipe Probe
0100711	1	75x75x42mm Junction Box	Bag 6	Pipe Probe
0100712	2	M20 Black Plastic Lock Nut	Bag 2	Fix to Electrical Panel
0100XXX	2	M20 Short bush	Bag 2	Fix to Electrical Panel
0100713				
0100714	6	60 x 60mm Poly Bag	Bag 1-6	
0100715	1	230mm x 325mm Poly Bag	Bag 7	
0100716	1	Site Fitting Kit Bagging	Bags 1-7	
		Cables & Probes Supplied		
0100200	2	CCH Heater CCT Cable 3M		Nearest heaters
0100210	3	CCH Heater CCT Cable 6M		Other heaters
0100220	1	CCH Supply cable 2M		Mains supply
0100230	1	CCH Earth Cable (external 2M)		Earth cable to Pack panel
0100706	5m	Twisted Pair Screened Cable	Bag 7	Pressure signal
0600009	1	MT0403. Thermistor Air Probe, 6m, Black Cable		Ambient Air probe
0600040	1	MT0405. Thermistor pipe Probe, 6m, Grey Cable		Suction Temperature Pipe Probe

Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

Installation

a. Enclosure Access



To remove the CHO-02 enclosure cover, always ensure the power is disconnected then undo the 4 x M5 cover fixing screws on the front face of the cover, slide the cover up and then lift off.
The cover has 4 internal fixings which move up 10mm in a slots in the base.
The cover earth wire still connects the cover to the base.

To replace the cover, place the cover 10mm up on the base and move until the 4 internal fixings mate with the slots in the base. Slide the cover down and replace the 4 x M5 cover fixing screws. W 150mm H 250mm D 40 mm

b. Placement

The unit is ideally to be positioned at eye height at the end of the pack electrical panel closest to the pack controller as shown opposite.
The unit has only IP22 protection .
Normal access into the Pack control panel is via the gland(s) at the rear of the optimiser so a 20 mm hole is required in the plant room electrical panel.

c. Fixing

The unit fixes to the Pack panel with 4 screws, after removing the cover, hold the unit against the panel and mark though the holes (note the top two are keyed)

For steel skinned panelwork use the 4 x 25mm Self drilling screws and fit plastic end caps

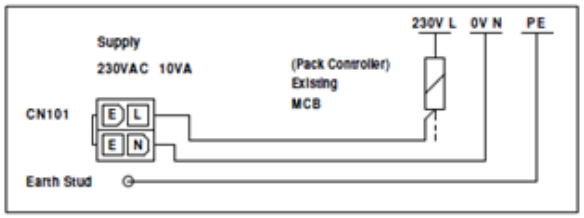
		Cables & Probes Supplied		
0100200	2	CCH Heater CCT Cable 3M		Nearest crankcase heaters inhibit
0100210	3	CCH Heater CCT Cable 6M		Other crankcase heaters inhibit
0100220	1	CCH Supply cable 2M		Mains supply from isolator
0100230	1	CCH Earth Cable (external 2M)		Earth cable to Pack panel
0100706	5m	Twisted Pair Screened Cable	Bag 7	Pressure signal
0600009	1	MT0403. Thermistor Air Probe, 6m, Black Cable		Ambient Air probe
0600040	1	MT0405. Thermistor pipe Probe, 6m, Grey Cable		Suction Temperature Pipe Probe

Decide how cables above are to be run and knock out appropriate gland holes (20mm) before mounting panel.
Cable entry can be either top or bottom or base of the of the unit .
20mmm locknuts and bushes are provided in bag 2 for glands into the electrical panel.

0100707	6	4.8x25mm Self Drill Screw	Bag 3	Fix to Electrical Panel
0100712	2	M20 Black Plastic Lock Nut	Bag 2	Fix to Electrical Panel
0100XXX	2	M20 Short bush	Bag 2	Fix to Electrical Panel

d. Provision Of Power Supply

The CHO-02 system requires a 240Vac 6A rated supply.
It should be directly connected to the mains via a protected circuit (6A MCB) in an existing plantroom electrical panel.
This is normally the same MCB as used by the pack controller.



A mains cable is provided

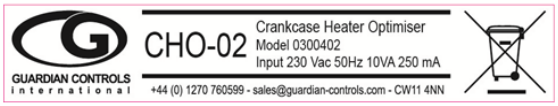
0100220	1	CCH Supply cable 2M

Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

CHO-02 Rating Label

The Rating Label for the CHO-02 is fitted at the bottom of the unit.

14X80mm

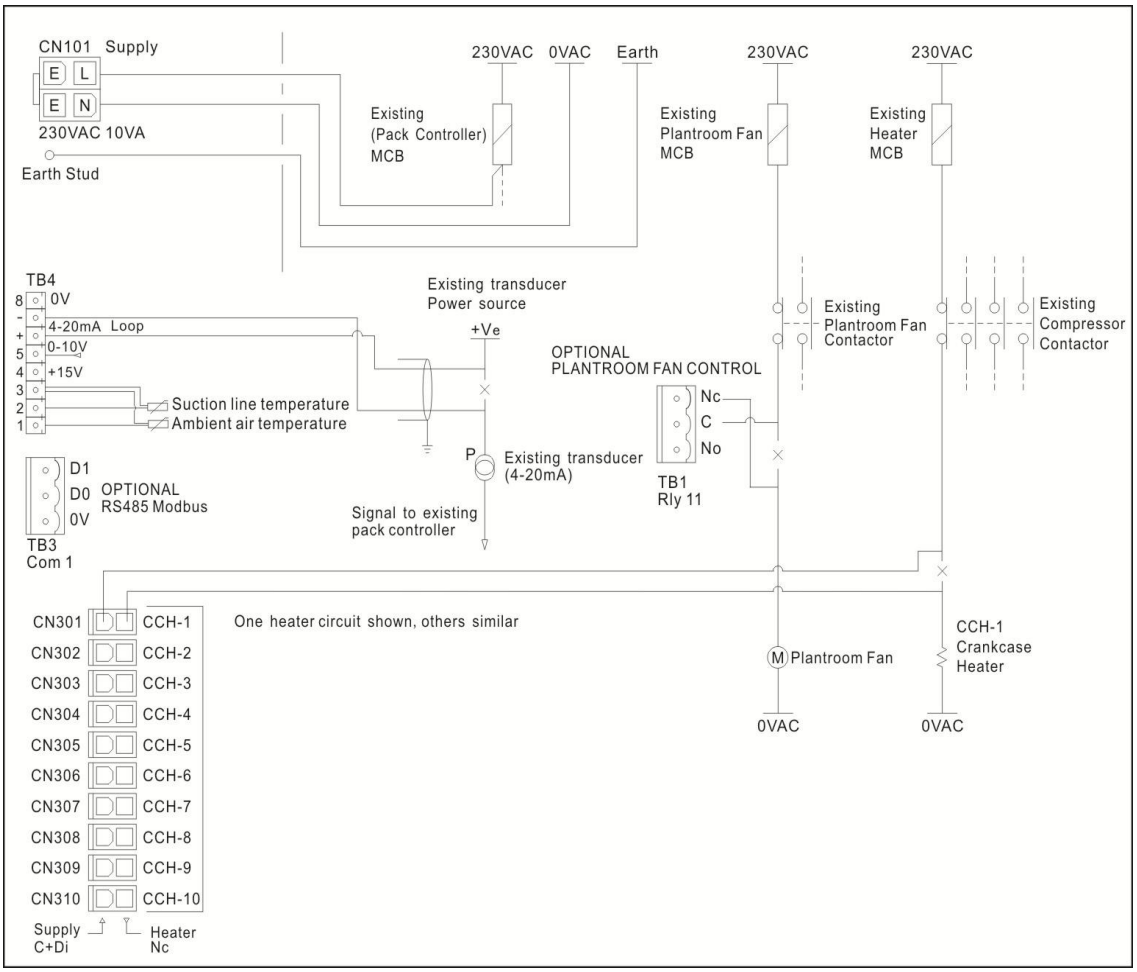


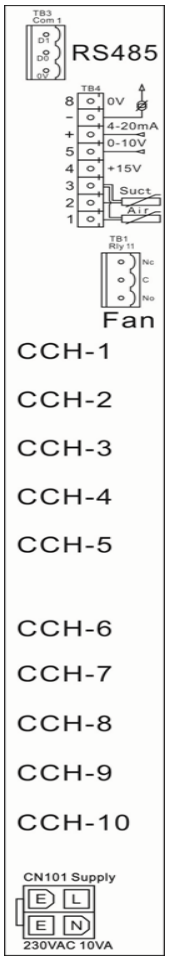
14X30mm

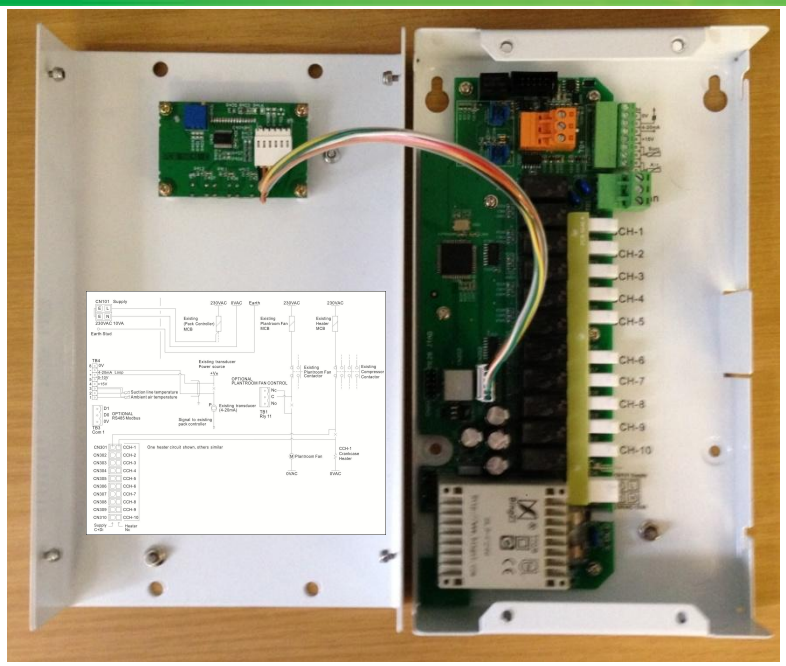
The warning label to disconnect before removing cover is on the front face of the cover

CHO-02 Crankcase Heater Wiring

A circuit diagram label is printed inside the cover of unit. A termination label is in the base







Interior view standard

with IPM-o4 Ethernet Option

Terminals and Connectors

CN201 Analog Input Measurements

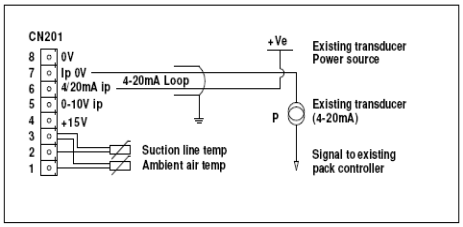
Terminals for

i) 4-20ma (or 0-5V) suction pressure feed from existing transducer (page 9)

ii) Suction line temperature probe(page 9)

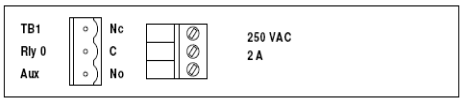
iii) Ambient Temperature probe . (page 9)

The suction line temperature pipe probe is normally routed via the back of the pack panel to the suction line as detailed in page9.



TB1 . Fan Control Output (C/O)

Terminals for single phase Plant room Ventilation Fan inhibit (N/C 2A) control if the ambient temperature is below a preset limit (20C). The N/C contacts open to inhibit the fan at low temperature.



CN301- CN310 Crankcase Heater Input Output Cables

2-Way Connectors for crankcase heater inhibit cables

Standard Cables lengths are 3m and 6m

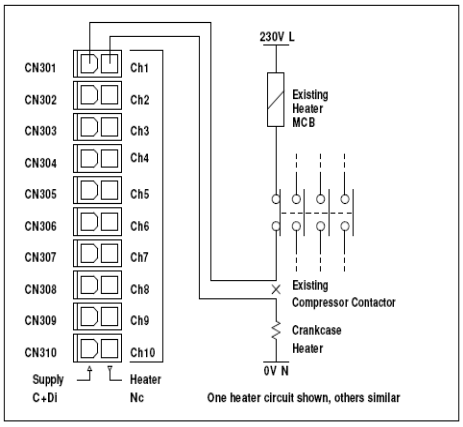
CN xxx pin 2 wire colour:- **RED** 230vac **SUPPLY**

CN xxx pin 1 wire colour:- **ORANGE** 230vac **HEATER**

2x 3m and 3 x 6m cables are normally supplied with the unit

Additional 3M/6M cables are available at extra cost if required.

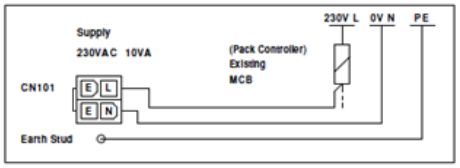
Heater cables are fitted between compressor contactor and heater.
When optimizing, the N/C contact (3A) is opened to inhibit the heaters and so save energy.
The unit always powers up with heaters permitted .
230Vac Heater Demand Inputs are taken from N/C contact of Relay.



CN101 Mains supply 230Vac 50Hz

The optimizer requires a supply of 230VAC 50Hz 10VA 250ma

See d. Provision Of Power Supply page 6



Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

Pressure Transducer

The pressure readings are tapped off the existing pack controller pressure transducer using .

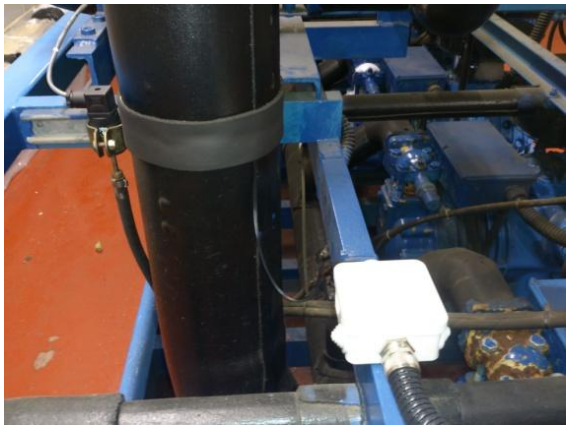
0100706 0100703	5m 2	Twisted Pair Screened Cable Red Butt Splice Terminal	Bag 7 Bag 1	Pressure transducer connection

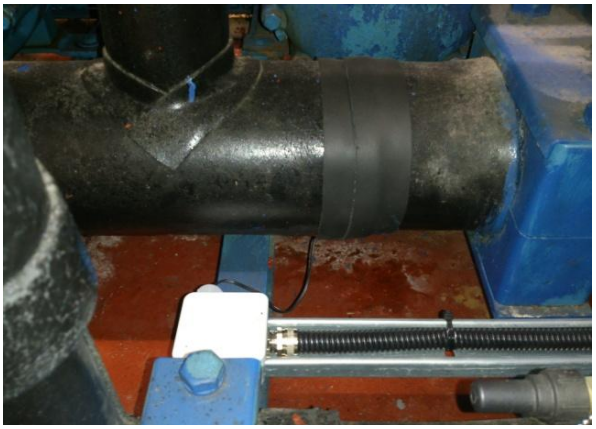
Using the red butt slice terminal to break the 4-20ma circuit, the existing pressure transducer panel terminals or pack controller terminals are used to derive the pressure measurement in series.

During installation the unit must be configured for the transducer type signal selection 4-20ma or 1-6v.
The pressure range max and min but also be configured (eg -1 barg to 8 barg) and any necessary Offset and Gain signal calibration used to ensure the optimiser has the same value of pressure as thee pack controller. If the pack controller displays pressure in PSIG then please contact Guardian.
See Set Configuration menu page 15

The Suction Temperature Probe

The suction line temperature pipe probe is normally routed from CN201- T2 and T3 via the rear gland at the back to the pack panel then via a Metal or Plastic glanded conduit to the suction line. The conduit is terminated in a suitably glanded local junction box which then glands the probe cable to the suction line.
The Temperature Probe is fitted into the insulated pipework with suitable insulating tape as below.





Ambient Temperature Probe

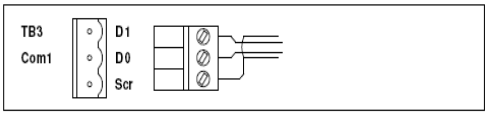
To fit the ambient air sensor, firstly remove a knock out and fit 20mm gland supplied into the top right knock out. The gland is then used to secure the plantroom ambient temperature probe.
The probe is connected to CN201- T1 and T3

Ambient Air probe **in gland**

0600009	1	MT0403. Thermistor Air Probe, 6m, Black Cable		Ambient Air probe
0100704	1	M20 Grey Cable Gland	Bag 2	Temperature probes

TB3 RS 485 Communications (19200baud)

Requires RS485 Modbus Option module Part 0600401 fitted to function correctly. See CHO Communications Manual.



Guardian Controls International Ltd. Email sales@guardian-controls.com
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN. Tel +44(0)1270760599 Fax +44(0)1270766804

SETUP OPERATION

CHO-02 LCD Display and Pushbuttons

The CHO-02 has an integral 2X16 LCD display with 3 pushbuttons buttons for viewing latest values, history data, setup and configuration settings using a Menu Tree.

Power LED

A green Led indicator labelled POWER shows mains supply present

Pushbuttons

The 3 buttons which have the following functions

⌃	**'up' button**	goes to previous MENU, display or parameter selection in sequence or increases a parameter setting data value.
⌄	**'down' button**	goes to the next MENU, display or parameter selection or decreases a parameter setting data value.
↵	**'select / enter' button**	selects a parameter for changing or enters the new Sub-Menu sequence or parameter data value.

Default Display

The default STATUS display shows
Optimiser STATUS = (OK, ALARM, FAULT), Pack Identity (eg LT1)
Ambient temperature degree C and Suction pressure in barg.

Pressing ⌄ on the default STATUS display steps in sequence through all Measured and Calculated values of the MAIN MENU

To select a particular sub Menu press ↵ when displayed.

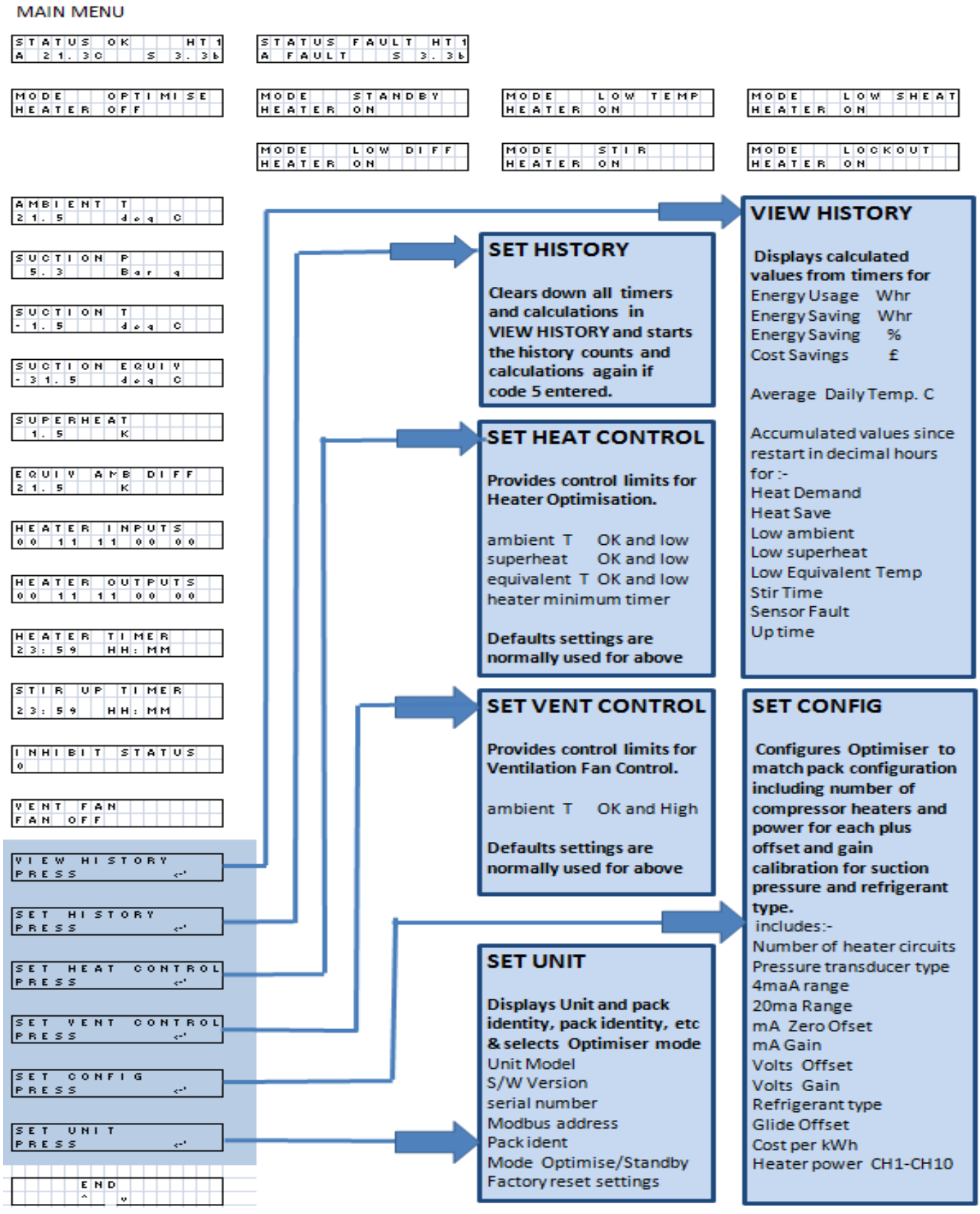
Change Parameter Settings

To change a parameter setting, press ⌄ until the appropriate parameter is displayed and then press ↵
The last block on the lower line starts flashing to indicate the parameter is now ready to edit.
Use ⌃ 'up' **or** ⌄ 'down' to reach the required new value and then press ↵ **enter'**

Guardian Controls International Ltd. Email sales@guardian-controls.com
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN. Tel +44(0)1270760599 Fax +44(0)1270766804

CCH-02 LCD Display Menus

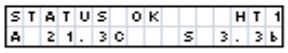
LCD Display Menu Tree

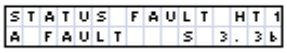


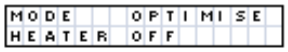
Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

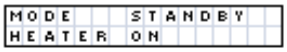
Main Menu

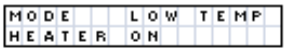
MAIN MENU

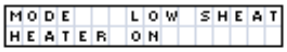


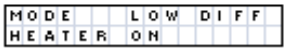


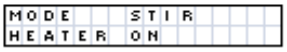


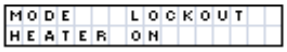




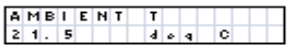




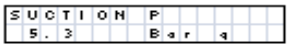




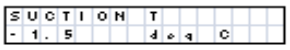
When the controller has all heaters on conditions satisfied there is a xx minute period where 'LOCK OUT' is displayed to indicate that although all is ok now the controller has just recovered from a heaters on condition and will not optimise for another xx minutes.



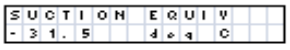
Latest measured value of Ambient Temperature (deg C)



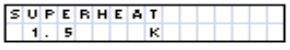
Latest measured value of Suction Pressure (Bar g))
Value replaced by FAULT if probe faulty



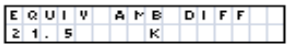
Latest measured value of Liquid line Temperature (deg C)
Value replaced by FAULT if probe faulty



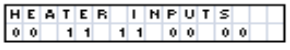
Equivalent Suction Temperature dependent on Refrigerant.



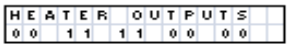
Superheat derived from Suction Line Temperature and Equivalent Temperature



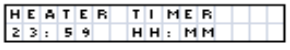
Ambient Differential derived from Ambient Temperature and Equivalent Temperature



Heater demand inputs states H1 to H10 (0 =OFF, 1= ON)

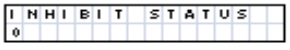


Heater inhibited outputs states H1 to H10 (0 =OFF, 1= ON)

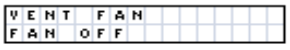


time that must elapse before heater inhibit can change state again.
The xx minute delay is set by parameter 12036 Minimum Heater On Timer.

Counts down from 2359 until stir up time is reached when optimizer inhibit is set for stir up time.
Stir up time is performed every 24 hours to ensure the heaters are used every day.



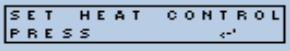
Optimiser Inhibit status (0= normal: 1 = optimiser operation inhibited by stir up, ambient differential, superheat or equivalent temperature events until heater timer reaches zero)



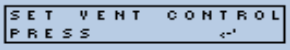
Plantroom Ventilation Fan state (if used)

Press enter ↵ to
View History from Restart page 13

Press enter ↵ to Set History page 13

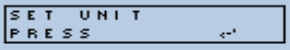


Press enter ↵ to Set Heat page 14

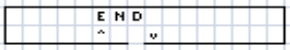


Press enter ↵ to Set Ventilation Fan page 14

Press enter ↵ to Set Configuration page 15



Press enter ↵ to Set Unit page 16



Use ⌃ 'up' **to select MENUs** **or** ⌄ 'down' to cycle through status, mode and latest values on MAIN MENU

Guardian Controls International Ltd. Email sales@guardian-controls.com
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN. Tel +44(0)1270760599 Fax +44(0)1270766804

View History from Restart

VIEW HISTORY FROM RESTART

ENERGY DEMAND 244750.00 WHrs	Calculation of energy demand in Wh since restart or clear counters
ENERGY SAVE 231155.11 WHrs	Calculation of energy saved in Wh since restart or clear counters
ENERGY SAVE 55.10 %	Calculation of Total energy saved as percentage since restart or clear counters
COST SAVE £ 1155.55	Calculated Cost saving since restart or clear counters
AMBIENT T 1D AVG 24 deg C	24 hour Average Ambient Plant room Temperature
HEAT DEMAND 1345:50 Hrs	Heat Demand counter accumulates total hours that any crankcase heater is requested. This is detected by the 230vac digital input on the appropriate heater supply line
HEAT SAVE 1145:50 Hrs	Heat Save counter accumulates total hours that any crankcase heater is requested but inhibited by the relay outputs because of optimizer conditions.
LOW AMBIENT 10:50 Hrs	This counter accumulates total hours that crankcase heaters cannot be optimized due to low ambient temperature conditions
LOW SUPERHEAT 0:10 Hrs	This counter accumulates total hours that crankcase heaters cannot be optimized due to low superheat temperature conditions.
LOW EQUIV DIFF 1645:20 Hrs	This counter accumulates total hours that crankcase heaters cannot be optimized due to low equivalent differential temperature conditions.
STIR TIME 45:20 Hrs	This counter accumulates total hours that crankcase heaters cannot be optimized due to the stir function in operation.
SENSOR FAULT 0:00 Hrs	This counter accumulates total hours that crankcase heaters cannot be optimized due to a sensor fault.
UNIT UP TIME 2745:00 Hrs	This counter accumulates total hours that the CHO-02 has been running since initial restart or the last time the history data was cleared using SET HISTORY below..
END <-	Press enter ↵ to return to MAIN MENU

Set History

To clear down all History calculations and Timers in order to start a new energy test comparing results to the kWh measured by an independent kWh meter:-

Select Clear Counters by pressing ↵

Increase ⇑ the value to 5 and press ↵ to ensure it is not accidental

This will rest all View history counters and Timers.

SET HISTORY

CLEAR COUNTERS Set to 5 0	Must be set to 5 to clear History data counters
END SET HISTORY PRESS <-	Return to MAIN MENU

Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

Set Heater Inhibit Controls

SET HEAT

AMBIENT T OK NO HEAT > 12	Crankcase heaters inhibited when Ambient Temp. above this limit.
AMBIENT T LOW HEAT < 10	Crankcase heaters permitted below this limit The heaters still remain permitted up to 10 mins after the Low conditions has cleared
SUPERHEAT OK NO HEAT > 6	Crankcase heaters inhibited when Superheat above this limit
SUPERHEAT LOW HEAT < 4	The limits ensure that the heaters are permitted so that the compressor has a chance of boiling off any liquid refrigerant that gets back to it due to a faulty controller or valve for example. When the pack controller detects a low superheat condition it should trip all the compressors, so even if the ambient conditions are ok the extra heat will assist any liquid reaching the sump to be removed. The heaters still remain permitted up to 10 mins after the low condition has cleared.
EQUIV DIFF OK NO HEAT > 15	Crankcase heaters OFF when Equivalent temperature Differential above this limit
EQUIV DIFF LOW HEAT < 10	Crankcase heaters ON when Equivalent Temperature Differential below this limit The heaters remain ON up to 10 mins after Low conditions have cleared
HEAT TIMER 2.0	Minimum Heater ON timer setting (Hours) Timer is in 0.1 hour steps, ie 2.0 is 2 hours which is the default value. This is just a guess at a time to allow fault conditions to clear and any refrigerant to have boiled off.
END SET HEAT PRESS <-'	Press ↵enter to return to MAIN MENU

*** * * The Values displayed above are factory default settings and should not require adjustment during Installation. * * ***

Set Ventilation Fan Inhibit controls

SET VENT

AMBIENT T OK NO VENT < 20 C	Plant room Ventilation Fan switches OFF below this limit
AMBIENT T HIGH VENT > 25 C	Plant room Ventilation Fan switches ON above this limit
END SET VENT PRESS <-'	Press ↵enter to return to MAIN MENU

*** * * The Values displayed above are factory default settings and should not require adjustment during Installation. * * ***

Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

Set Configuration

SET CONFIG

HEATER CIRCUITS 5	Number of Heater circuits fitted to Compressors (10maximum) 5 compressors in example Press ↵enter to change: use ⌃ 'up' **or** ⌄ 'down' to reach the required new value and then press ↵
TRANSDUCER TYPE 4-20mA	TRANSDUCER TYPE 1-6V / TRANSDUCER TYPE Esc — Pressure Transducer Selection
PRESSURE AT 4mA -1.0	4ma pressure in Barg If the pack controller displays pressure in PSIG then please contact Guardian.
PRESSURE AT 20mA 24.0	20ma pressure in Barg
mAMP OFFSET -00.76 0	mAmp Offset adjustment to match pack controller pressure display value Press ↵enter to change: use ⌃ 'up' **or** ⌄ 'down' to reach the required new value and then press ↵ To see the effect of the change to the pressure value by pressing ↵enter
mAMP GAIN 23.59 30	mAmp Gain adjustment to match pack controller pressure display value Press ↵enter to change: use ⌃ 'up' **or** ⌄ 'down' to reach the required new value and then press ↵ To see the effect of the change to the pressure value by pressing ↵enter
VOLTS OFFSET 0	Volts offset adjustment if 1-6v transducer selected
VOLTS GAIN 0	Volts gain adjustment if 1-6v transducer selected
REFRIGERANT R404A	Press ↵enter to change: use ⌃ 'up' **or** ⌄ 'down' to reach the required Refrigerant and then press ↵ REFRIGERANT R407A / REFRIGERANT R407F / REFRIGERANT R422D Required to work out Equivalent Temperature and Superheat If Siite refrigerant not in list Please contact Guardian. REFRIGERANT R744 / REFRIGERANT Esc Press ↵enter on ESC to leave selection as it was.
GLIDE OFFSET 0.0	
COST PER KWH £0.096	**Required to work out cost savings**
HEATER POWER C1 125	**Required to work out energy savings**
HEATER POWER C2 125	Required to work out energy savings
HEATER POWER C3 125	Required to work out energy savings
HEATER POWER C4 125	Required to work out energy savings
HEATER POWER C5 125	Required to work out energy savings
HEATER POWER C6 125	Required to work out energy savings
HEATER POWER C7 125	Required to work out energy savings
HEATER POWER C8 125	Required to work out energy savings
HEATER POWER C9 125	Required to work out energy savings
HEATER POWER C# 125	Required to work out energy savings
END SET CONFIG PRESS ↵	Press ↵ enter to return to MAIN MENU

**** * * ALL ITEMS IN GREEN SHOULD BE SETUP DURING INSTALLATION * * ****

Guardian Controls International Ltd.
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN.
Email sales@guardian-controls.com
Tel +44(0)1270760599 Fax +44(0)1270766804

Guardian Controls www.guardian-controls.com

Set Unit

SET UNIT

UNIT READ ONLY CCH A01		CHO model (READ ONLY).
SW VER READ ONLY 1007		Software version number (READ ONLY).
SER NO READ ONLY 123456		CHO Batch Number / Serial number(READ ONLY).
MODBUS ADDRESS 1		Modbus address if communications options fitted.
PACK IDENTITY HT1		Pack identity LT1 to LT9; HT1-HT9 and N/A.
MODE OPTIMISE	MODE STANDBY	**Selecting OPTIMISE inhibits heaters if OK to do so and saves energy.** **Selecting STANDBY reverts to normal heater operation. (Optimiser OFF)**
ADJUST CONTRAST 10		LCD display contrast adjustment 1-10
FACTORY RESET Set to 5 0		Reset to factory default Settings by pressing ↵ Then Increase ⌃ the value to 5 and press ↵ Wait until 'done' is displayed (30 secs)
END SET UNIT PRESS <-		Return to MAIN MENU

******* ALL ITEMS IN GREEN SHOULD BE SETUP DURING INSTALLATION *******

Guardian Controls International Ltd. Email sales@guardian-controls.com
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN. Tel +44(0)1270760599 Fax +44(0)1270766804

Parameter setup and system checks during Installation.

During installation, the Optimiser must be configured and setup using the Menus on page11.
In particular setup all items marked in green on Set Configuration page 15 and Set Unit page 16.

Use the Main Menu Status display to check the suction pressure matches the displayed suction pressure on the pack controller. Use offset and gain calibration to adjust the values if necessary.

Use View History page 13 to check that the uptime and other accumulators are increasing and a sensible Energy saving is in progress if heaters are inhibited.

Guardian Controls International Ltd. Email sales@guardian-controls.com
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN. Tel +44(0)1270760599 Fax +44(0)1270766804

CHO Crankcase Heater Optimiser Communications

The CHO optimisers can be fitted with one of the following OPTIONAL communication modules

a) RS485 Modbus Module @ 19200 baud Part Number 0300401
b) IPM-04 Ethernet TCP/IP Modbus module Part Number 0300 600
c)

For further details of fitting and using CHO Modbus communications see Handbook:-
'CHO Crankcase Heater Optimiser Communications'

Guardian Controls International Ltd. Email sales@guardian-controls.com
56, Crewe Road, Sandbach, Cheshire, England CW11 4NN. Tel +44(0)1270760599 Fax +44(0)1270766804