

Electrical Installation Requirements

Care should be taken to separate the power and signal cables to prevent electrical interference and possible damage due to inadvertent connection.

The power outputs are fitted with suppressors to protect against electrical interference when switching off solenoid valves or contactors. It is therefore essential to observe the output polarity. The line voltage should be connected to the terminals marked **LN** and the switched loads to **LD**.

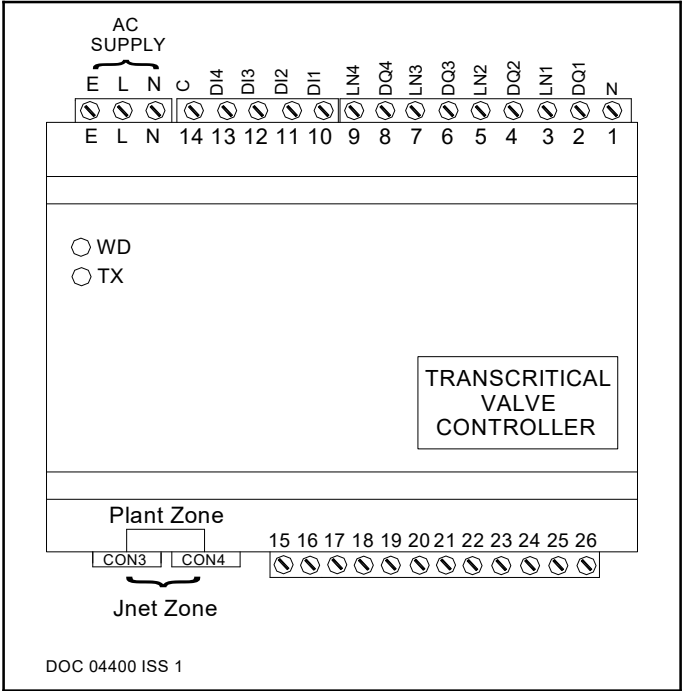
The plant inputs are electrically isolated. A volt free contact should be connected for the logical conditions stated below between the input and common **C** (14).

The control supply neutral must be connected to terminal 1 for EMC operation.

CE Conformance

This unit conforms with the relevant EU standards when installed according to the JTL Installation Requirements for this product.

Digital Output				
1	LN LD	3 2	Suppressed	Not used
2	LN LD	5 4	Suppressed	Enable Flash Gas Valve
3	LN LD	7 6	Suppressed	Watchdog
4	LN LD	8 9	Unsuppressed	High discharge pressure
Digital Inputs				
1		14 10	Volt Free	Valve fault
2		14 11	Volt Free	Fans Healthy
3		14 12	Volt Free	Low liquid level
4		14 13	Volt Free	Auto
Analogue OUTPUT				
1	+ -	19 20	0-10 V	Cooler Fan speed
2	+ -	17 20	4-20mA	Transcritical valve
		26 16	0V +24v	External Supply
Analogue INPUT				
1	+ -	21 22	5k Thermistor	Cooled Gas Temperature
2	+ -	21 23	5k Thermistor	Ambient Air Temperature
	+ -	15 24	4-20 mA	Cooler Pressure
	+ -	17 20	4-20mA	Liquid pressure



Use of Maintenance Unit

The controller can be checked and the operation adjusted using a JTL portable maintenance unit which plugs into the controller. Each item of information has an item number. The more important items are listed in the tables overleaf. Examples:

To read item 22 press: **ITEM** **2** **2** **ENTER**

To set item 50 to 650 Press: **ITEM** **5** **0** **ENTER** **SET** **6** **5** **0** **ENTER**

To correct errors press: **CANCEL**

To select next or previous items press: **+** and **-**

Initial Commissioning Settings

The controller has 1 set of data built in to its program for use during commissioning. Initialize to this data by setting item 9 to 1234. This loads into the controller a suitable set of data, adjustments should then be made as necessary.

If a JTL communications network is connected to the controller then the unit number should be set on item 1.

Pressure Display

The pressure can be displayed in psi, bar or MPa as selected by item 179.

The HP150 controller drives the JTL LCD14 display using a CAB75 cable. Various cable lengths are available.

Transcritical CO2 Operation

When the external ambient reaches a certain level the CO2 becomes supercritical. At this point the CO2 gas cooling strategy has to change as the condenser changes over to being a gas cooler.

The decision to switch to supercritical control from conventional subcritical control is made using the 'adjusted ambient temperature' (item 35).

The adjusted ambient temperature is calculated by taking the difference between the CO2 gas temperature (item 31) and the ambient temperature (item 32). This difference is then limited to 10K and multiplied by a percentage factor (item 36). The result is added to the ambient temperature to produce the adjusted ambient temperature.

When this value exceeds its setpoint (item 37) then supercritical mode control is put into operation. There is a deadband value (item 38) to control switching back to subcritical mode control.

Cooler Pressure Control - Subcritical

In subcritical mode the cooler acts as a conventional condenser, the pressure is controlled by the transcritical valve after the condenser using PI control against an optimised pressure setpoint calculated using the external ambient temperature and the design differential temperature for the condenser.

The head pressure (item 22) is floated to give differential temperature above the ambient condition. The differential (item 363) should be set to the condenser design condition to give maximum condenser efficiency. Setting 0.0 disables floating head (FH) control.

The outside ambient temperature (item 32) is read from sensor 2. If this is not available then it is read from the JTL network (item 899). If the outside temperature is not available then FH control is disabled.

The condenser operating temperature (item 365) is calculated from the discharge pressure (item 22) and the refrigerant type (item 157).

The target temperature (item 364) for the condenser control is calculated from the outside air temperature plus the design differential temperature. (item 32 + item 363).

The floating pressure setpoint (item 370) is calculated from the target temperature (item 364) and the selected refrigerant (item 157).

The minimum pressure setpoint (item 50) is used when floating head is disabled or when the outside air temperature is not available.

The maximum pressure setpoint (item 350) for the condenser is used to limit the floating head pressure.

Cooler Pressure Control - Supercritical

In supercritical mode the transcritical valve is controlled by PI control against a calculated pressure set point (item 370) calculated using a formula which takes a multiple (item 63) of the external ambient temperature (item 32) and adds a constant (item 64).

Cooler Exit Temperature Control - Subcritical

In subcritical mode the cooler fans are controlled by PI control against a calculated temperature setpoint (item 140) which endeavours to maintain the liquid level at a set level of subcooling (item 144).

Cooler Exit Temperature Control - Supercritical

In supercritical mode the cooler acts as a gas cooler where the fan speed is controlled by PI control against temperature setpoint calculated using a formula which takes a multiple (item 146) of the external ambient temperature and adds a constant (item 147).

Minimum Cooler Exit Temperature

The cooler exit temperature setpoint is limited to a minimum value calculated from the ambient temperature and a differential value set on item 143.

Fan Speed Control

The controller varies frequency the speed of the fans using a 0 - 10V signal. 0 V is for minimum speed and 10 V is maximum speed.

There are maximum and minimum fan speed control settings on item 359 & 358.

If the minimum setting is set >0 then, when the minimum speed is reached the fans stay running until the pressure falls below the cut out level (item 357).

There is a separate maximum fan speed setting for nighttime operation (item 368). Nighttime is deferred by a timer on the JTL network selected on item 369.

The fans can also be stopped if the transcritical valve closes (item 356).

Transcritical Valve Control

The controller opens the valve using a 0-10V signal 0V is for valve closed and 10V is for valve fully open.

Daylight Saving

When connected to a JTL network this controller can operate by displaying daylight saving time for its time and defrost schedule. Daylight saving operation is selected by setting item 18. The connected network controller then adjusts the times automatically during the daylight saving period.

Control Response

The controller uses proportional and integrated control algorithms to control the outputs. These require gain and time constant to adjust the response of the control of outputs.

Output smoothing is available to reduce instability of the outputs where necessary.

Pressure Healthy

The HP155 can be used in conjunction with other controllers. There is an output which indicates if the discharge pressure is within acceptable limits which can be connected to other systems. The acceptable pressure level is set as item 55

Liquid Pressure Monitoring

The CO2 liquid pressure can be monitored by connecting a liquid pressure transducer.

This is used for monitoring and alarm purposes only.

Pressure Alarms

The pressures are constantly monitored and compared with the high alarm level and low alarm level. Different alarm levels are available for subcritical and transcritical operation.

If the current pressure goes outside the set range for a short time period then an alarm is given.

The time delay is achieved by integrating the difference between the alarm level and the actual pressure over a period of 30 seconds. This means that the larger the difference the faster the alarm occurs.

Pressure Transducer Alarms

The pressure transducers are constantly checked and if, after a 15 minute time delay, the output goes outside the acceptable range an alarm is given (item 91).

If there is a pressure transducer fault, the outputs are set to a settable backup value.

Alarm Display

Various alarms are indicated on the pressure displays. Typical messages displayed are:

P.Flt	Plant fault (auto input not present) - (highest priority)
Hi.dP	High cooler pressure
FAn	Condenser fan failure (lowest priority)

The alarm conditions are flashed alternately with the pressure. In the event of there being more than one alarm the highest priority alarm is displayed

ADJUSTABLE PARAMETERS				HP155
	Item	Function	Range	Units
PRESSURE CONTROL	50 350	Pressure setpoint (minimum) Pressure (maximum)	575 to 725 1200 - 1600	psi psi
	363 55	Subcritical Floating discharge temperature differential Discharge safety level	5 to 15 1200 to 1600	K psi
	63 64	Supercritical OAT multiplier OAT constant	0 - 30 400 - 1400	psi
COOLER EXIT TEMPERATURE CONTROL	144	Subcritical Sub cooling setpoint	0.0 - 10.0	K
	146 147	Supercritical OAT multiplier OAT constant	1.0 - 1.6 0.0 to 10.0	K
PRESSURE ALARM	52 51 62 61 72 71	High condensing pressure (subcritical) Low condensing pressure (subcritical) High cooling pressure (transcritical) Low cooling pressure (transcritical) High liquid pressure Low liquid pressure	725 to 1200 300 to 600 1200 - 1600 600 - 1200 650 - 800 200 - 650	psi psi psi psi psi psi
PRESSURE TRANSDUCERS	122 422 123 423	Cooler transducer Discharge transducer full scale (at 20 mA) Liquid transducer liquid transducer full scale (at 20 mA)	0=Disabled 1=Enabled 1450 - 1750 0=disable 1 = enable 1450 to 1750	psi psi
TEMPERATURES	131 132 143 36 37 38	Cooler exit temperature Ambient temperature Minimum cooler exit differential Adjusted ambient factor Adjusted ambient setpoint Adjusted ambient deadband	0=disabled 1=enable 0=disabled 1=enable 0 - 10 0 - 50 21 - 27 1 - 4	K % °C K
FAN SPEED CONTROL	54 56 395 396 359 358 357 356 360 361 368 369 397 389	Time constant (subcritical) Time constant (supercritical) Gain (subcritical) Gain (supercritical) Maximum cooler fan speed Minimum cooler fan speed Discharge pressure control Stop fans when transcritical valve shut Fan speed reduction temperature Fan speed top temperature Maximum speed at night Timer for nighttime operation No of steps in backup Fan output smoothing	1 - 250 1 - 250 5 - 200 5 - 200 50 - 100 0 - 25 500 - 700 0=disabled 1=enabled 5 - 20 -5 - 10 50 - 100 0 - 8 0 - 100 0 - 5 0=Disabled	% % psi °C °C %
VALVE CONTROL	374 375 376 377 379	Time constant (subcritical) Gain (subcritical) Time constant (supercritical) Gain (supercritical) Valve output smoothing	1 - 250 5 - 200 1 - 250 5 - 200 0 - 5 0=Disabled	
DISPLAY	179 178 189	Display units - pressure Display units - temperature Backlight control	0 - MPa 1 - psi, 2 - bar 0 - Celsius 1 =Fahrenheit 0 - off 1 - on 2 - off flashes alarm 3 - on flashes alarm	
JNET FUNCTIONS	1 18	Unit number Daylight saving operation	0.1 - 899.7 0= standard time, 1 daylight saving time	

OTHER USEFUL ITEMS			
Item	Function	Item	Function
22	PRESSURE	391	FAN SPEED CONTROL
23	Cooler Pressure	392	Speed (%)
148	Liquid pressure	899	Forced speed
149	Average cooler pressure (1hr)		Outside Temperature
	Average liquid pressure (1hr)	371	VALVE CONTROL
	CONTROL	372	Output (%)
370	Active pressure setpoint		Forced output
364	Cooler target temperature		TEMPERATURES
365	Condenser operating temperature	31	Cooler exit
		32	Ambient
		35	Adjusted ambient

Relay Output Rating

2A resistive

Supply Requirements

Installation Information

24 Vac (optional)

Applicable Documentation

Item Numbers

Doc No. 04347

Firmware Variations

Doc No. 04348

Connections Diagram

Doc No. 04890

230 V ac 48-62 Hz Supply 6 VA maximum inputs 2 mA maximum

Note: The information contained in this document applies to the current version of the unit supplied with it. Full operating manuals, item number and software variation information can be obtained from the supplier JTL Systems.



This unit conforms with the relevant EU standards when fitted in accordance with its installation instructions.