

**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**.

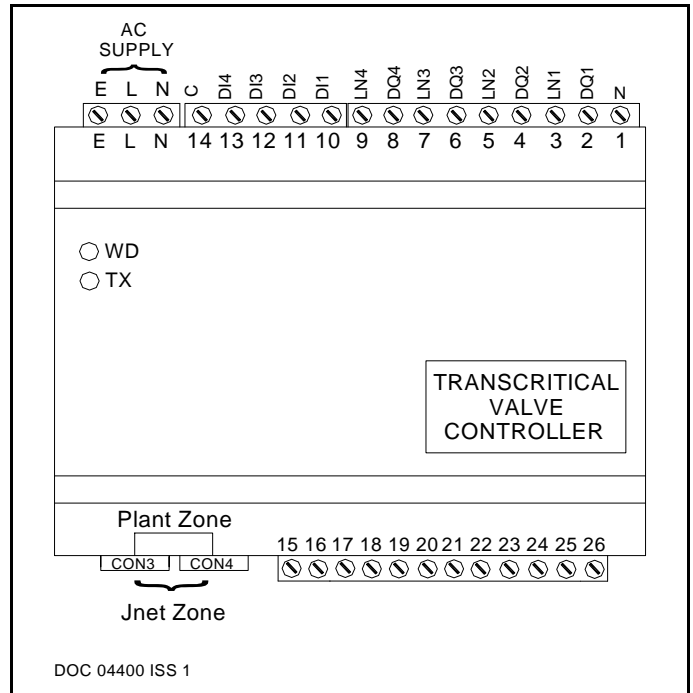
The plant inputs are electrically isolated. A volt free contact should be connected for the logical conditions stated below between the input and common **C** (14).

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	0-10 V	Transcritical valve
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 transcritical. 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 transcritical control from conventional subcritical control is made using a combination (item 36) of the CO2 gas (item 31) and ambient temperatures (item 32) which produces the 'adjusted ambient temperature' (item 35). When this value exceeds its setpoint (item 37) then transcritical 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 - Transcritical**

In transcritical 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 endeavouring to maintain the liquid level at a set level of subcooling (item 144).

**Cooler Exit Temperature Control - Transcritical**

In transcritical 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).

**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.

**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 HP150 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

**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				HP150
	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	Transcritical OAT multiplier OAT constant	16 - 36 400 - 800	psi
COOLER EXIT TEMPERATURE CONTROL	144	Subcritical Sub cooling setpoint	-1.0 to -8.0	K
	146 147	Transcritical OAT multiplier OAT constant	1.2 - 1.6 0.0 to 3.0	K
PRESSURE ALARM	52	High condensing pressure (subcritical)	725 to 1200	psi
	51	Low condensing pressure (subcritical)	300 to 600	psi
	62	High cooling pressure (transcritical)	1200 - 1600	psi
	61	Low cooling pressure (transcritical)	600 - 1200	psi
	72	High liquid pressure	650 - 800	psi
	71	Low liquid pressure	200 - 650	psi
PRESSURE TRANSDUCERS	122	Cooler transducer	0=Disabled 1=Enabled	
	422	Discharge transducer full scale (at 20 mA)	1450 - 1750	psi
	123	Liquid transducer	0=disable 1 = enable	
	423	liquid transducer full scale (at 20 mA)	1450 to 1750	psi
TEMPERATURES	131	Cooler exit temperature	0=disabled 1=enable	
	132	Ambient temperature	0=disabled 1=enable	
	36	Adjusted ambient factor	20 - 80	
	37	Adjusted ambient setpoint	21 - 26	oC
	38	Adjusted ambient deadband	1 - 4	oC
FAN SPEED CONTROL	54	Time constant (subcritical)	1 - 250	
	56	Time constant (transcritical)	1 - 250	
	395	Gain (subcritical)	5 - 200	
	396	Gain (transcritical)	5 - 200	
	368	Maximum speed at night	50 - 100	%
	369	Timer for nighttime operation	0 - 8	
	397	No of steps in backup	0 - 100	
	389	Fan output smoothing	0 - 5 0=Disabled	
VALVE CONTROL	374	Time constant (subcritical)	1 - 250	
	375	Gain (subcritical)	5 - 200	
	376	Time constant (transcritical)	1 - 250	
	377	Gain (transcritical)	5 - 200	
	379	Valve output smoothing	0 - 5 0=Disabled	
DISPLAY	179	Display units - pressure	0 - MPa 1 - psi, 2 - bar	
	178	Display units - temperature	0 - Celsius 1 =Fahrenheit	
	189	Backlight control	0 - off 1 - on 2 - off flashes alarm 3 - on flashes alarm	
JNET FUNCTIONS	1	Unit number	0.1 - 899.7	
	18	Daylight saving operation	0= standard time, 1 daylight saving time	

OTHER USEFUL ITEMS			
Item	Function	Item	Function
22	PRESSURE Cooler Pressure	391	FAN SPEED CONTROL Speed (%)
23	Liquid pressure	392	Forced speed
148	Average cooler pressure (1hr)	899	Outside Temperature
149	Average liquid pressure (1hr)		VALVE CONTROL
	CONTROL	371	Output (%)
370	Active pressure setpoint	372	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  
inputs 2 mA maximum

24 Vac (optional)

**Applicable Documentation**

Item Numbers      Firmware Variations      Connections Diagram  
Doc No. 04347      Doc No. 04348      Doc No. 04318

230 V ac 48-62 Hz    Supply 6 VA 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.

