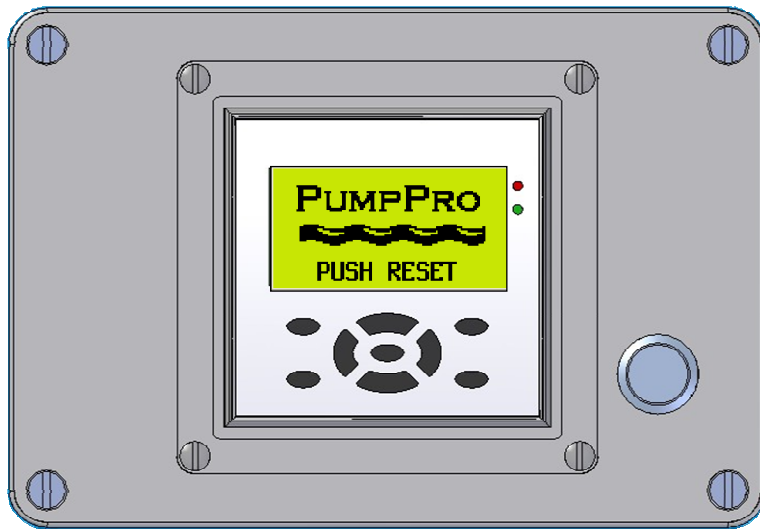


# OPERATOR'S MANUAL

## PumpPro™ Pump Protection System V3.1



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## **Pump Protection System**

### **1 INTRODUCTION**

The PumpPro™ Pump Protection System protects against some well-known hazards that may occur when pumping emulsion blasting agents with a progressive cavity pump. It will not necessarily provide complete protection for pumping all explosives products under all circumstances. Consult with your explosives supplier for pump safety information for the specific products you are using.

#### ***1.1 Hazards detected***

By their very design, progressive cavity pumps have high internal friction. In normal operation, the fluid flowing through the pump provides lubrication and cooling to limit frictional heating. Regardless of the fluid involved, if a progressive cavity pump runs dry (without any fluid) or deadheaded (without fluid flowing through the pump) it can suffer internal damage due to frictional heat buildup. In the case of pumping blasting agents, this excessive heat buildup can have even more dangerous consequences.

PumpPro uses analog sensors to measure pumping pressure, product temperature, and flow rate. The system controller continuously compares these sensor inputs with limit values and stops the pump before a hazard has time to develop. A run timer limits the time of unattended pump operation, and a rupture disc protects the pump against extreme high pressures. The objective is to stop the pump when a hazard is detected that may lead to excessive heat buildup.

PumpPro detects the following potentially hazardous conditions:

1. Low flow...flows below the low limit for more than 20 seconds.
2. Low pressure...pressure below the low limit for more than 20 seconds.
3. High pressure...pressure above the high limit.
4. High temperature...temperature above the high limit.
5. Run time...pump run time exceeding the time limit.
6. Extreme pressure...pressure at the limit of pump capability.

By using different safety devices, PumpPro detects a variety of conditions and provides redundant protection against potential hazards.

	<b>Safety device</b>	<b>Hazard detected</b>
1.	Flow sensor – low limit	Running dry or deadheaded
2.	Pressure sensor – low limit	Running dry
3.	Pressure sensor – high limit	Running deadheaded
4.	Temperature sensor	Heat buildup
5.	Run Timer	Unattended operation
6.	Rupture disc	Running deadheaded

### **1.2 TRIP and RESET**

PumpPro uses an internal relay to control the operation of the pump. Normally the control relay is energized all the time. When an alarm condition occurs, the control relay will TRIP to the de-energized state and the pump will stop. After a TRIP, the operator must RESET the relay to the energized state before the pump will run again.

### **1.3 Fail-safe operation**

PumpPro is designed for fail-safe operation. The idea behind fail-safe is that most major malfunctions, including power failure, would cause the control relay to de-energize. For that reason, the de-energized state of the pump control relay is the TRIP condition.

### **1.4 Hydraulic by-pass valve**

The PumpPro control relay controls the pump via a 3-way hydraulic solenoid valve. In the TRIP condition, the valve is “de-energized”, and it opens a port to by-pass hydraulic oil around the pump’s hydraulic drive motor. Like the control relay, the hydraulic solenoid is fail-safe because the de-energized state of the hydraulic valve is the TRIP condition.

## 2 OPERATOR RESPONSIBILITY

Only trained and authorized personnel should operate a pump that uses a PumpPro Pump Protection System. It is always the operator's responsibility to operate the pump properly. PumpPro should be considered a backup safety system for a properly trained operator. Operator training should include recognition of hazardous conditions that could occur while operating the pump, and an understanding of the hazards for the product in use.

### WARNING



**PUMPING BLASTING AGENTS WITH AT PROGRESSIVE CAVITY PUMP IS POTENTIALLY HAZARDOUS. NO ONE SHOULD OPERATE SUCH A PUMP WITHOUT TRAINING IN UNDERSTANDING AND RECOGNIZING ALL POTENTIALLY HAZARDOUS CONDITIONS.**

### 2.1 Before operation

Before operating a pump with PumpPro protection, the operator shall have:

- Received training in the hazards of pumping emulsion blasting agents.
- Understand all Standard Operating Procedures for pumping blasting agents.
- Read (or have explained) and understand this Operator's Manual.

### 2.2 Modifications or alterations

Modifications or alterations to the PumpPro safety system must be authorized by the original equipment manufacturer. Any modifications that by-pass the safety features of PumpPro are not authorized.

### WARNING



**BYPASSING ANY PART OF THE PUMPPRO SAFETY SYSTEM MAY RESULT IN A HAZARDOUS OPERATING CONDITION. IF THE SYSTEM FAILS TO OPERATE PROPERLY, THE PROBLEM MUST BE IDENTIFIED AND CORRECTED BEFORE RESUMING PUMPING OPERATIONS.**

### 2.3 Inspection and maintenance

The operator must inspect the PumpPro system prior to each use in accordance with the instructions in this Operator's Manual.

#### 2.3.1 Daily inspection

- ✓ Check the security of all electrical enclosures, conduit, and fittings.
- ✓ Check the sensors for any indication of external damage.
- ✓ Check the sensing spool bore for product buildup or obstructions.
- ✓ Check that the controller detects the sensors signals.
- ✓ Check that the controller can be RESET to the RUN screen.

### 2.4 Removal from service

PumpPro be must removed from service for repair if the system is not in proper operating condition.

### 2.5 Repair and return to service

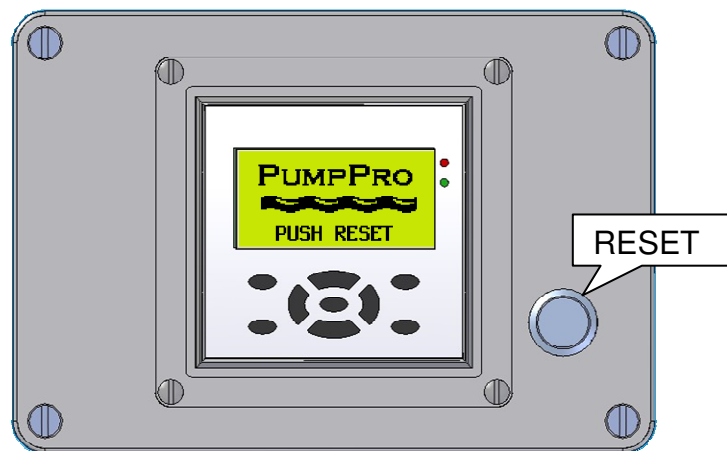
Only qualified personnel should repair the unit and approve it for return to service. All repairs must conform to the manufacturer's original specifications.

### 3 NORMAL OPERATION

PumpPro is operated from a control unit that houses a small PLC with a graphical screen. When the pump is running, the screen displays the pumping pressure, product temperature, and product flow rate. When the controller detects an alarm condition, it will TRIP the pump OFF and display a message identifying the cause. Messages in languages other than English can be loaded into the display.

#### 3.1 *RESET pushbutton*

The RESET pushbutton is to the lower right of the PumpPro display unit. It is used to RESET the control relay from a TRIP, and when first starting up.



The PumpPro STARTUP Screen includes the message PUSH RESET.

#### 3.2 *LED indicator lights*

The RED and GREEN LED lights beside the upper right corner of the display screen indicate the state of the control relay. GREEN is for ON and indicates the RESET condition. RED is for OFF and indicates the TRIP condition – the product pump will not run when the PumpPro is tripped.

When RESET is pushed, the control relay will turn ON, the GREEN LED will illuminate, and PumpPro will change to the RUN screen.

### 3.3 RUN screen

The RUN screen shows PRESSURE, TEMPERATURE, and FLOW. This is the normal operating screen that will always be visible in the RESET condition.

The RUN Screen provides the operator with a lot of useful information while running the pump. It takes place of a mechanical pressure gauge and a thermometer, and it shows how the pump is operating compared to the high and low alarm points.

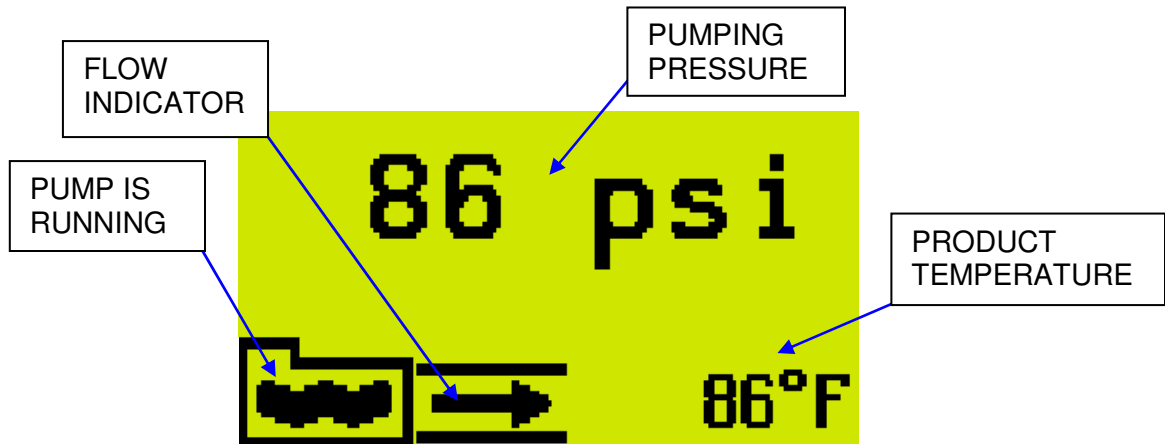


Figure 1. PumpPro RUN Screen (pump running)

PRESSURE and TEMPERATURE are displayed in US units (PSI and degrees F) or in international units (BAR and degrees C).

FLOW is indicated by an arrow.

The PUMP RUNNING indicator is visible whenever hydraulic pressure is present at the hydraulic motor that drives the pump.

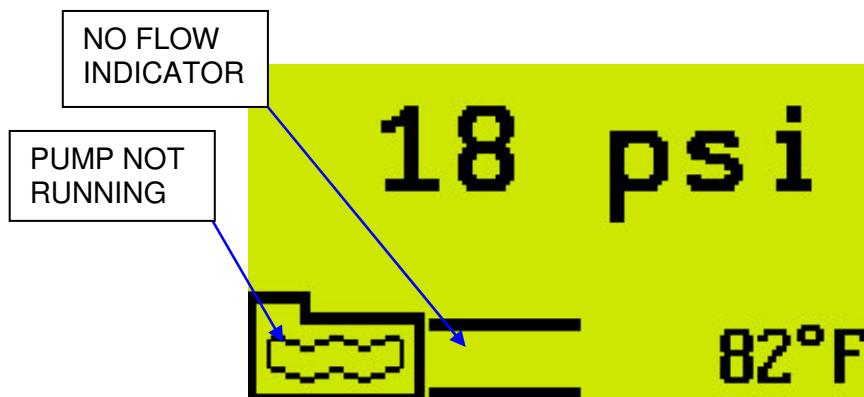


Figure 2. PumpPro RUN Screen (pump not running)

Since the product pump and water pump are generally on the same hydraulic circuit, to run only the water pump it is necessary to turn on the pump circuit and allow the product pump to be bypassed. You can tell if the pump circuit is engaged with the pump being bypassed by looking for the **H<sub>2</sub>O** indicator as show below.

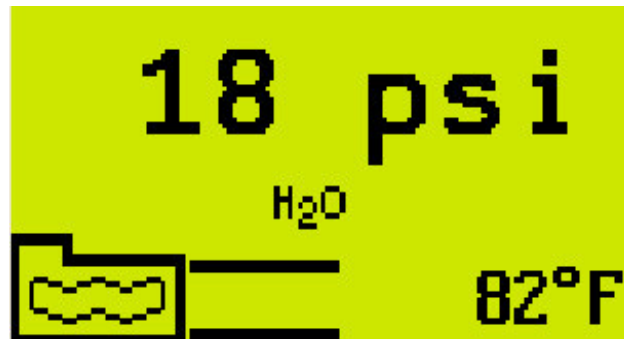


Figure 3. PupPro RUN Screen (only water running)


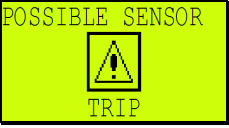

### **3.4 Normal operation**




RESET PumpPro prior to beginning operation. Pumping operations may proceed when the RUN screen is displayed. After that, just use the normal Start and Stop controls for operating the pump, and monitor the pumping operation on the PumpPro screen.





**NOTE:** If a message screen is displayed instead of the RUN screen, refer to Section 4 - MESSAGE SCREENS for help in diagnosing the problem.

## 4 MESSAGE SCREENS

The following alarm conditions will trip the control relay to “off” and disable the pump. The alarm message will display and the warning symbol will flash. Push the RESET pushbutton to re-energize the control relay and re-enable the pump to run. The display will return to the RUN screen.

<i>Message</i>	<i>Cause</i>	<i>Remedy</i>
 <p>LOW FLOW TRIP</p>	<p><b>Low Flow Trip</b> occurs when the flow sensor indicates flow <b>BELOW</b> the low limit for more than 20 seconds while the hydraulic pressure sensor indicates that the pump <b>IS</b> running.</p> <p>This alarm condition could be caused by a bad flow sensor setpoint, a failure of the flow sensor, or a bad hydraulic pressure sensor.</p>	<ul style="list-style-type: none"> <li>• Check for product available at the pump.</li> <li>• Look at “PUMP RUNNING” indicator to make sure hydraulic pressure sensor is operating properly. Refer to <b>Section 3.3</b> for more information.</li> <li>• Change flow sensor setpoint. Refer to <b>Section 5.1</b> for more information.</li> </ul>
 <p>POSSIBLE SENSOR TRIP</p>	<p><b>Possible Sensor Failure Trip</b> occurs when the flow sensor indicates flow <b>ABOVE</b> the low limit for more than 20 seconds while hydraulic pressure sensor indicates that the pump is <b>NOT</b> running.</p> <p>This alarm condition could be caused by a bad hydraulic pressure sensor, a bad flow sensor setpoint, or a failure of the flow sensor.</p>	<ul style="list-style-type: none"> <li>• Look at “PUMP RUNNING” indicator to make sure hydraulic pressure sensor is operating properly. Refer to <b>Section 3.3</b> for more information.</li> <li>• If hydraulic pressure sensor is operating properly, then change the flow sensor setpoint. Refer to <b>Section 5.1</b> for more information.</li> </ul>
 <p>LOW PRESSURE TRIP</p>	<p><b>Low Pressure Trip</b> occurs when the pressure sensor indicates pressure <b>BELOW</b> the low limit for more than 20 seconds while the pump <b>IS</b> running.</p>	<ul style="list-style-type: none"> <li>• Check for product available at the pump.</li> <li>• Increase the pump speed to increase pressure.</li> <li>• Reduce water injection to increase pressure</li> </ul>

 <p>HIGH PRESSURE TRIP</p>	<p><b>High Pressure Trip</b> occurs when the pressure sensor indicates pressure <b>ABOVE</b> the high limit. There is no time delay on a high pressure trip.</p>	<ul style="list-style-type: none"> <li>• Check for blockage in hose or piping.</li> <li>• Reduce pump speed to decrease pressure.</li> <li>• Increase water injection to reduce pressure.</li> </ul>
 <p>HIGH TEMPERATURE TRIP</p>	<p><b>High Temperature Trip</b> occurs when the temperature sensor indicates temperature <b>ABOVE</b> the high limit.</p> <p>NOTE: The use of temperature as an alarm is optional. If the PumpPro is not set up with this option at the factory, the temperature sensor will only be used for monitoring.</p>	<ul style="list-style-type: none"> <li>• Cease operation and notify your supervisor at once.</li> </ul>
 <p>RUN TIME OUT TRIP</p>	<p><b>Run Time Out Trip</b> occurs when the pump run time exceeds the time limit. The pump run timer automatically resets to zero whenever the pump stops.</p>	<ul style="list-style-type: none"> <li>• Push RESET at any time while the pump is running to reset the pump run timer to zero.</li> <li>• Check that the PUMP RUNNING indicator on the RUN screen is <b>not</b> visible when the pump is <b>not</b> running. See <b>Section 5.4</b> for more information.</li> </ul>

	<p><b>Supply Valve Closed</b> occurs because the supply valve on a Repump emulsion tank is closed.</p>	<ul style="list-style-type: none"> <li>• Open the emulsion tank supply valve.</li> <li>• Check for broken wire from the air pressure switch.</li> <li>• Refer to <b>Section 5.5</b> for more information</li> </ul>
	<p><b>Pressure Sensor No Signal</b> occurs when the controller does not have a signal from the pressure sensor.</p>	<ul style="list-style-type: none"> <li>• Check for a broken wire from the sensor to the controller.</li> <li>• Refer to <b>Section 5.3</b> for more information.</li> </ul>
	<p><b>Flow Sensor No Signal</b> occurs when the controller does not have a signal from the flow sensor.</p>	<ul style="list-style-type: none"> <li>• Check for a broken wire from the sensor to the controller.</li> <li>• Refer to <b>Section 5.1</b> for more information.</li> </ul>
	<p><b>Temperature Sensor No Signal</b> occurs when the controller does not have a signal from the Temperature sensor.</p> <p>NOTE: The use of temperature as an alarm is optional. If the PumpPro is not set up with this option at the factory, the temperature sensor will only be used for monitoring.</p>	<ul style="list-style-type: none"> <li>• Check for a broken wire from the sensor to the controller.</li> <li>• Refer to <b>Section 5.2</b> for more information.</li> </ul>

## 5 SENSOR OPERATION

### 5.1 Flow Sensor

The PumpPro reads flow as a number from 0 to 100. However, the flow sensor output is very non-linear so it is not very useful for quantifying flow rate. For that reason, the RUN screen uses a flow/no-flow indicator. A flow setpoint determines the flow/no-flow threshold. When the flow reading exceeds the setpoint the PumpPro assumes it is now sensing actual product flow and it shows an arrow on the RUN screen.

Since different types of product could cause variations in flow measurement, it may occasionally be necessary to adjust the flow setpoint. But before you can make any adjustments, you will need to remove the Plexiglas cover to gain access to the PLC buttons shown below.

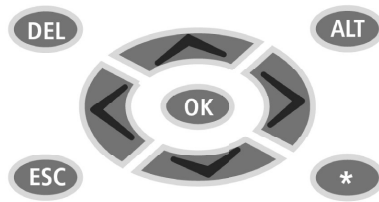


Figure 4, PLC buttons

Pressing the **ALT** key on the front of the PumpPro (while in the RUN screen) will change to the FLOW ALARM screen.



Figure 5. FLOW ALARM screen

In this screen you will see two numbers:

- The measured flow is displayed in the top right part of the screen. This measurement will change as the flow changes
- The flow setpoint is shown in the lower left of the screen.

You can adjust the flow setpoint by using the arrow keys on the PumpPro. The right/left keys will increase/ decrease the setpoint 5 at a time. The up/down keys will increase/ decrease the setpoint 1 at a time. You can exit this screen – returning to the RUN screen – by pressing the **ESC** key.

### 5.1.1 Flow Sensor Troubleshooting

The flow sensor outputs a 4-20mA signal to the PumpPro. If a sensor wire is broken, or if the sensor fails, the signal will fall to zero milliAmps. In this case, the PumpPro will trip on a **Flow Sensor No Signal** alarm. You will not be able to reset the PumpPro or run your product pump until the problem is solved.

### 5.2 Temperature Sensor

The PumpPro reads and displays product temperature on the RUN screen. The use of temperature as an alarm is optional\*. If the PumpPro is not set up with this option at the factory, the temperature sensor will only be used for monitoring and warning of low-temperature conditions.

A low temperature setpoint is used to warn the operator when the product drops below a given temperature. The low temperature warning causes the temperature display to flash – it does not trip the PumpGard or prevent the pump from running.

To adjust temperature setpoints, you must first go to the TEMPERATURE ALARM screen: From the RUN screen, press the **ALT** key. That will take you to the FLOW ALARM screen. Pressing the **ALT** key again will access the TEMPERATURE ALARM screen.



Figure 6. TEMPERATURE ALARM screen (default)

You can adjust the low-temperature setpoint by using the arrow keys on the PumpPro. The right/left keys will increase/ decrease the setpoint 5 at a time. The up/down keys will increase/ decrease the setpoint 1 at a time. You can exit this screen – returning to the RUN screen – by pressing the **ESC** key.

If your PumpPro has been set up to use temperature as an alarm, there are two ways temperature can cause an alarm condition (and prevent the pump from running):

- 1) Exceeding a high-temperature setpoint
- 2) Loss of temperature signal (e.g. cut signal wire, bad sensor, etc.)

You will see a slightly different screen that also shows the high-temperature setpoint if your PumpPro has been set to use temperature as an alarm (figure 7).



Figure 7. TEMPERATURE ALARM screen (w/ hi-temp setpoint)

To change the high-temperature setpoint †:

- 1) Press the **OK** key once. The low-temperature setpoint should start flashing.
- 2) Press the **>** (right arrow) key. The high-temperature setpoint should now be flashing.
- 3) Press the **OK** key again. The last digit of the high-temperature setpoint should now be flashing
- 4) Use the up/down arrow keys to increase/decrease the value of the digit and the left/right arrow keys to move between digits. In this way you can enter a new number.
- 5) Press the **ESC** key twice to exit editing mode.

† Note that the PumpPro will not allow you to increase the high-temperature setpoint beyond a maximum value programmed at the factory.

You can exit the TEMPERATURE ALARM screen by pressing the **ESC** key.

\*NOTE: By default, the PumpPro is not programmed to trip on high temperature or loss of temperature signal. Using temperature as an alarm is an option that must be specified so that the PumpPro can be programmed at the factory accordingly.

### 5.2.1 Temperature Sensor Troubleshooting

The temperature sensor outputs a 4-20mA signal to the PumpPro. If a sensor wire is broken, or if the sensor fails, the signal will fall to zero milliAmps. In the default case, no alarms will trip and you will still be able to pump; however, the temperature readout will now show a scrolling message that indicates that the temperature signal has been lost.

If, however, your PumpPro is set to use temperature as an alarm, the PumpPro will trip on a **Temperature Sensor No Signal** alarm. And you will not be able to reset the PumpPro or run your product pump until the problem is solved.

### **5.3 Pressure Sensor**

The pressure sensor outputs a 4-20mA signal to the PumpPro. If a sensor wire is broken, or if the sensor fails, the signal will fall to zero milliAmps. In this case, the PumpPro will trip on a **Pressure Sensor No Signal** alarm. You will not be able to reset the PumpPro or run your product pump until the problem is solved.

### **5.4 Hydraulic Pressure Switch**

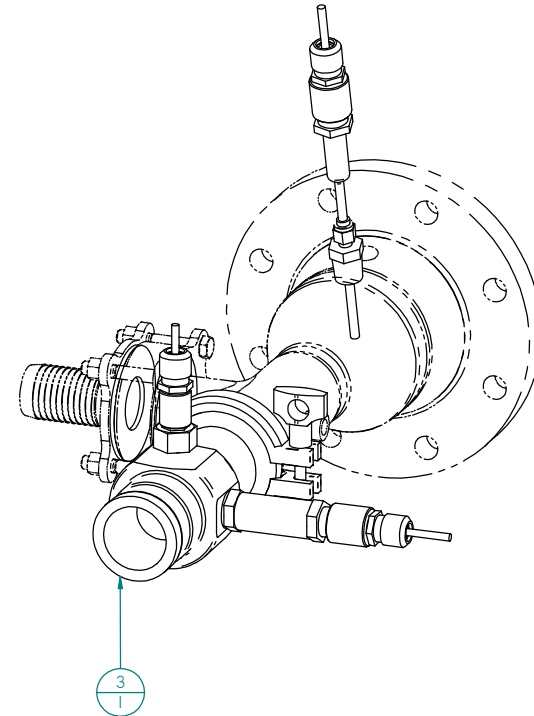
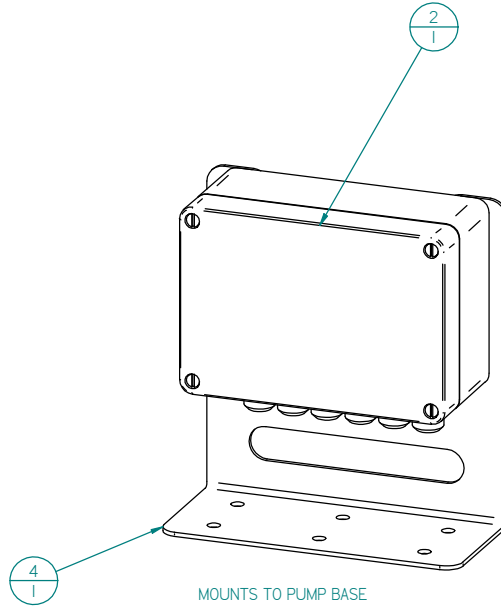
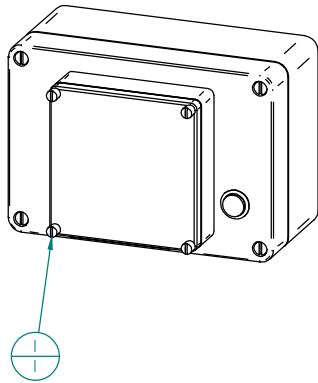
This pressure switch monitors hydraulic pressure in the pump hydraulic circuit. If the PumpPro senses the switch is closed, it assumes that the product pump circuit has been engaged. By using this pressure switch, the PumpPro can tell if the pump circuit is run either electrically or manually.

If the pressure switch leads are either cut or shorted, the PumpPro will not allow the pump to run, so it is important that this pressure switch be maintained.


### **5.5 Air Pressure Switch**

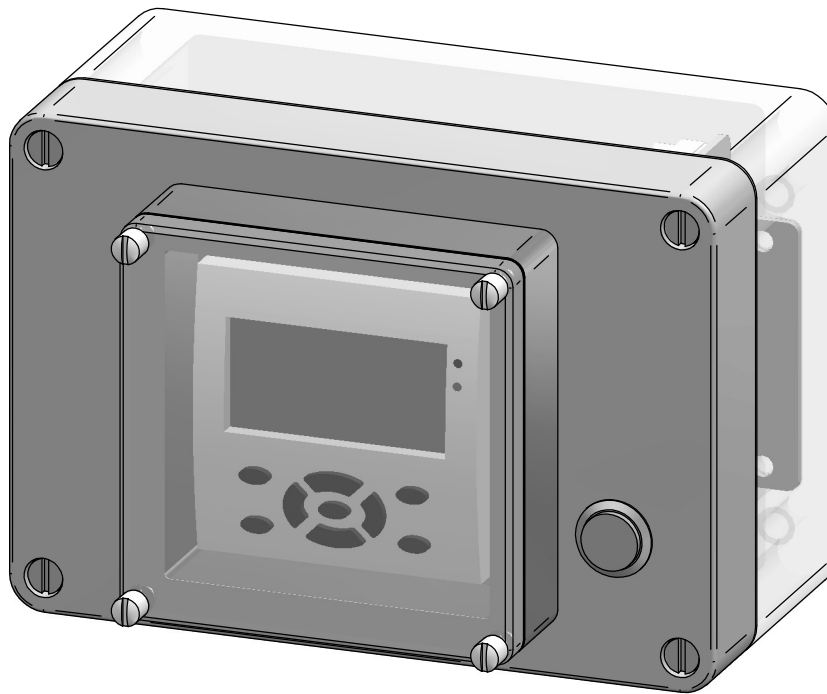
On trucks that have air-actuated emulsion tank valves, an air pressure switch is used to monitor the status of these valves. If the valves are closed (and hence the pressure switch is not closed), the PumpPro will not allow you to reset it. Only once the tank valves have been opened will you be able to reset the PumpPro.

## **6 MECHANICAL & ELECTRICAL DRAWINGS**




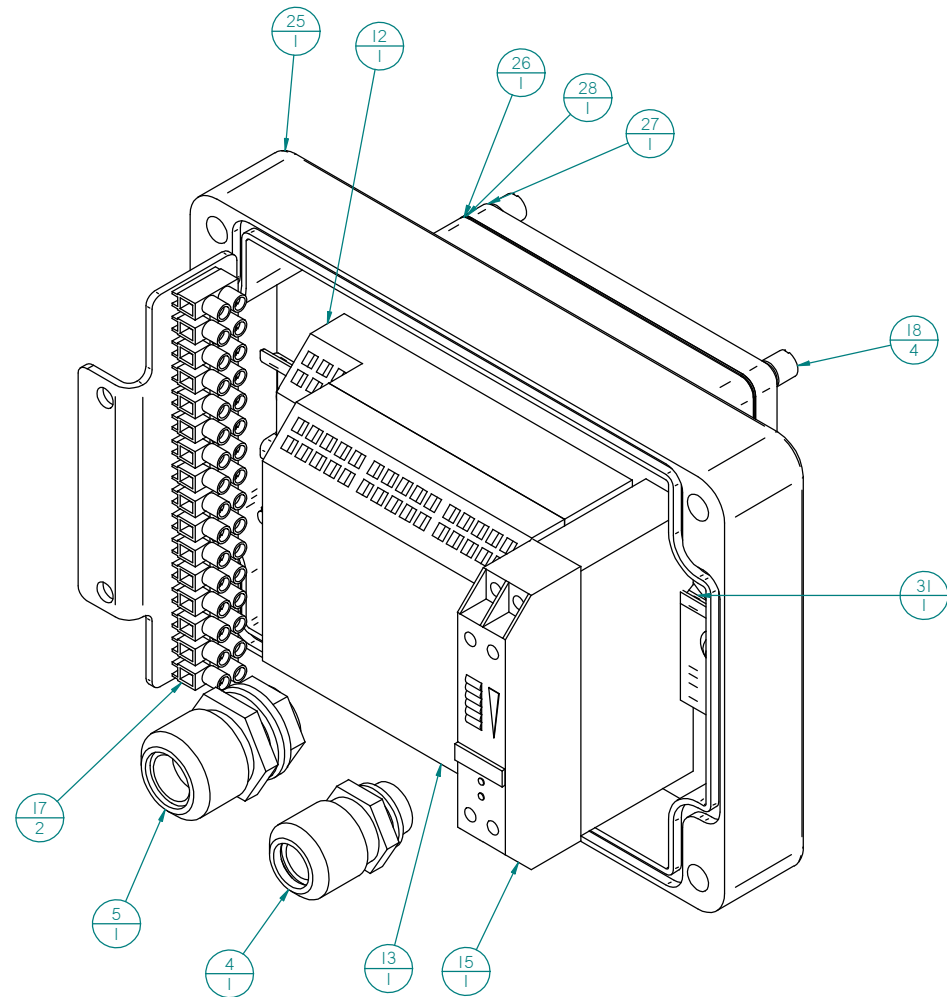
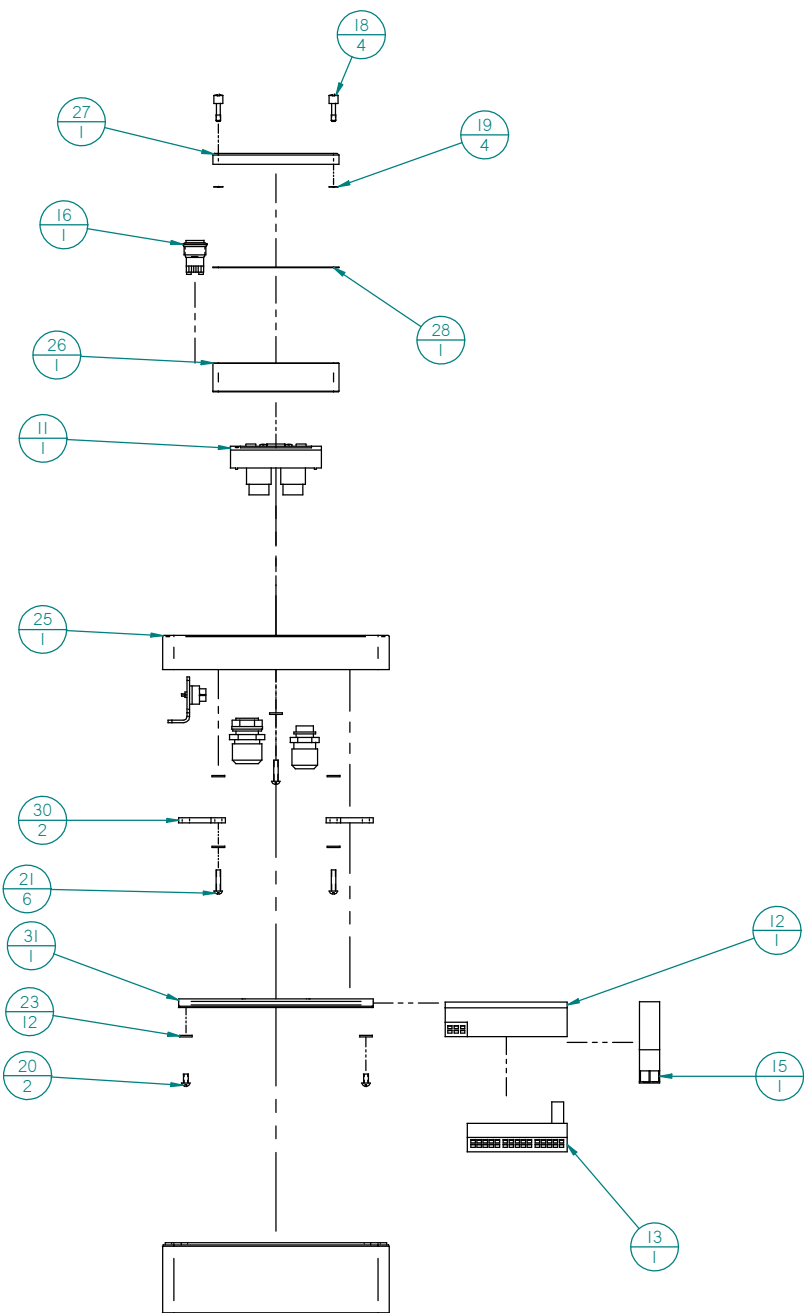
ITEM	QTY	DWG NO.	DESCRIPTION	Part ID
1	1	UPI015A10	PUMPPRO CPU ASSEMBLY	UPI015A10
2	1	UPI015A30	PUMPPRO JUNCTION BOX ASSEMBLY	UPI015A30
3	1	UPI015A50	PUMPPRO SENSOR ASSEMBLY UNIBORE 2 IN	UPI015A50
4	1	UPI015P18	MOUNTING PLATE PUMP PRO J-BOX	UPI015P18

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TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X = + .100 DECIMAL .XX = + .020 DECIMAL .XXX = + .005 ANGULARITY = + .05 DEG		THIRD ANGLE PROJECTION 			
DRAWN <b>DCOLE</b>	DATE <b>1/24/2005</b>	DWG NO. <b>UPI015A01</b>	REV <b>1</b>	SIZE <b>C</b>	
APPR		WEIGHT <b>0.0 lbm</b>	SHEET <b>1 OF 1</b>		



ITEM	QTY	DWG NO.	DESCRIPTION	Part ID
1*	3		RESISTOR 499 OHM .25 WATT 1 %	231.0223
2*	1		FITTING BODY HARNESSFLEX STRAIGHT NC12	231.6204
3*	1		FITTING BODY HARNESSFLEX STRAIGHT NC16	231.6206
4	1		FITTING CAP NUT HARNESSFLEX NC12	231.6208
5	1		FITTING CAP NUT HARNESSFLEX NC16	231.6209
6*	1		FITTING SEALING BUSHING HARNESSFLEX NC12	231.6210
7*	1		FITTING SEALING BUSHING HARNESSFLEX NC16	231.6211
8*	1		FITTING LOCKNUT HARNESSFLEX M20 THRD	231.6213
9*	1		FITTING SEALING WASHER HARNESSFLEX SWPG9	231.6214
10*	1		FITTING SEALING WASHER HARNESSFLEX SWM20	231.6215
11	1		MOELLER MFD DISPLAY MODULE MFD-80-B	231.8154
12	1		MOELLER MFD CPU MODULE MFD-CP8-ME	231.8155
13	1		MOELLER MFD I/O MODULE MFD-R16	231.8156
14*	1		MOELLER MFD TRANSPARENT SEAL MFD-80-XM	231.8157
15	1		TURCK SIGNAL PROCESSOR MK96-LI01	231.8161
16	1		SWITCH VANDAL PROOF BULGIN MP0037/2	231.8170
17	2		TERMINAL STRIP 2-SCREW 8-POLE MOLEX	231.8171
18	4		SCREW CAPTIVE KNURLED HEAD 8-32 X .62 SS	231.8172
19	4		SCREW RETAINER WASHER 8-32 SS	231.8173
20	2		SCREW MACHINE SL ROUND HD #8-32X.3125 SS	915.1234
21	6		SCREW MACHINE SL ROUND HD #8-32X.75 SS	915.1274
22*	4		NUT HEX #2-56 SS	950.9154
23	12		WASHER PLAIN FLAT #8	960.1214
24*	4		SCREW MACHINE SL ROUND HD #2-56X.625 SS	990.9154
25	1	UPI015A20	PUMPPRO CPU ENCLOSURE	UPI015A20
26	1	UPI015P10	PUMPPRO CPU DISPLAY BEZEL	UPI015P10
27	1	UPI015P11	PUMPPRO CPU DISPLAY WINDOW	UPI015P11
28	1	UPI015P12	PUMPPRO CPU DISPLAY WINDOW GASKET	UPI015P12
29*	1	UPI015P13	PUMPPRO CPU TERMINAL STRIP BRACKET	UPI015P13
30	2	UPI015P14	PUMPPRO CPU DIN RAIL BRACKET	UPI015P14
31	1	UPI015P15	PUMPPRO CPU DIN RAIL	UPI015P15

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TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X + .100 DECIMAL .XX + .020 DECIMAL .XXX + .005 ANGULARITY + .05 DEG		DRAWN: DCOLE DATE: 7/29/2005	DWG NO: UPI015A10 WEIGHT: 38.8 lbm	REV: 2 SIZE: C	SHEET: 1 OF 4



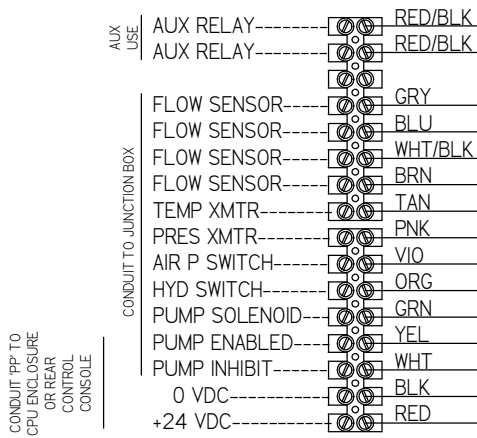
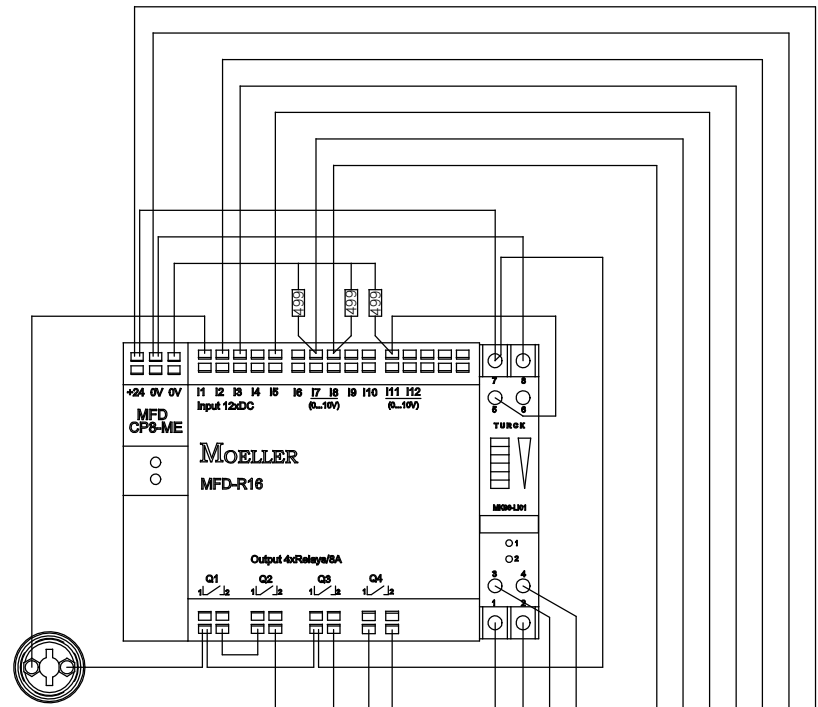
Last Changed 4/17/2006

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	 THIRD ANGLE PROJECTION	PROJECT:	
TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X ± .100 DECIMAL .XX ± .020 DECIMAL .XXX ± .005 ANGULARITY ± .05 DEG	DRAWN: DCOLE DATE: 7/29/2005	TITLE: PUMPPRO CPU ASSEMBLY	
	DWG NO: UPI015A10	REV: 2	SIZE: C
	APPR:	WEIGHT: 38.8 lbm	SHEET: 2 OF 4

**NOTE**  
 Conduit 'PP' (YEL, WHT, BLK, & RED) will run to the CPU enclosure if the truck is a quad with in-cab controls and Danfoss hydraulic valves for the pumping section. Otherwise, conduit 'PP' should go to the rear control console (i.e. to the box with the display screen).

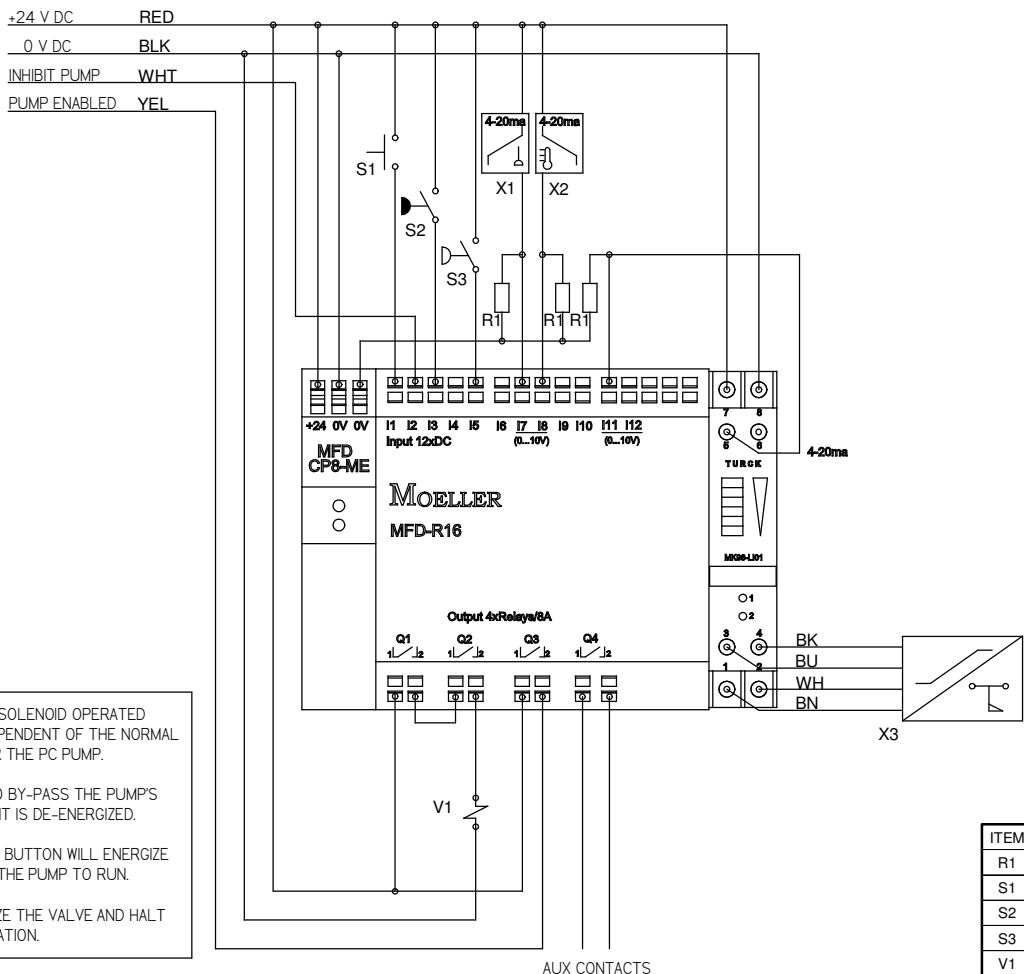
If run to the CPU, the wires should be hooked-up as follows:

PP CPU  
 RED -> T34  
 BLK -> T33  
 YEL -> T40  
 WHT -> T87



CPU WIRING DIAGRAM

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	THIRD ANGLE PROJECTION	PROJECT PUMPPRO CPU ASSEMBLY	DWG NO UPI015A10	REV 2	SIZE C
TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .XX ± .100 DECIMAL .XX ± .020 DECIMAL .XXX ± .005 ANGULARITY ± .05 DEG	DRAWN DCOLE	DATE 7/29/2005	WEIGHT 38.8 lbm	SHEET 3 OF 4	



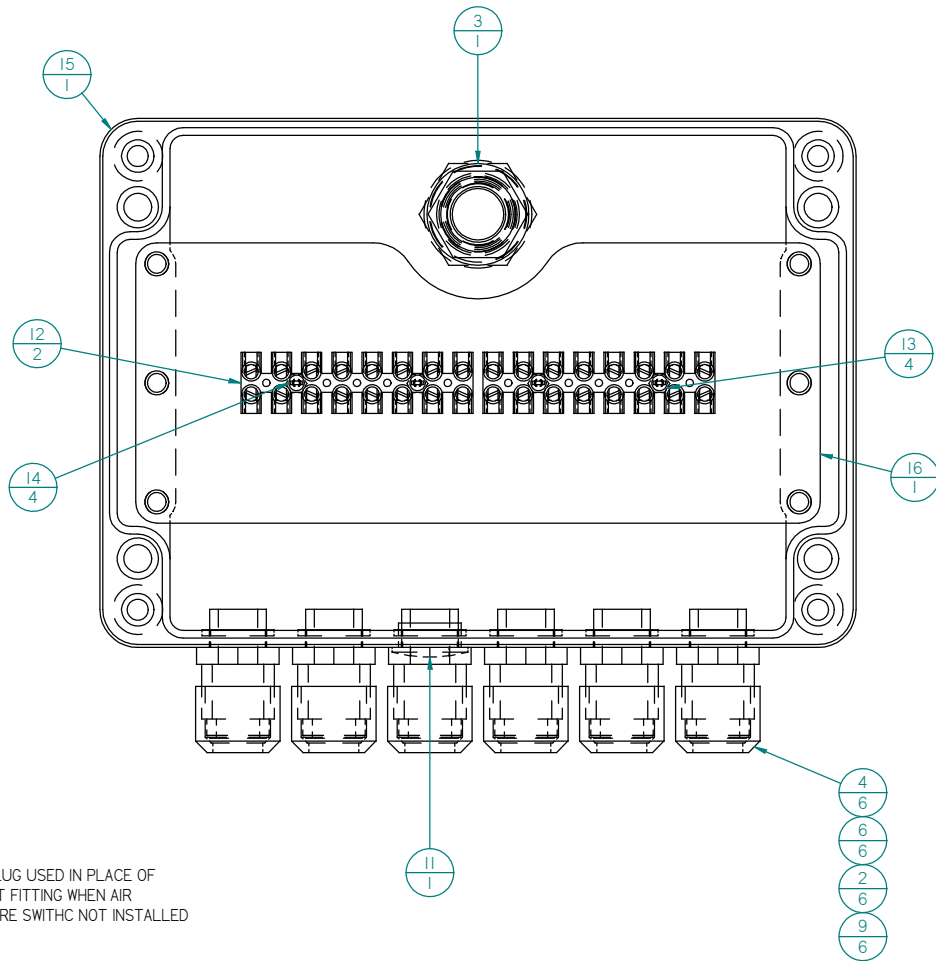
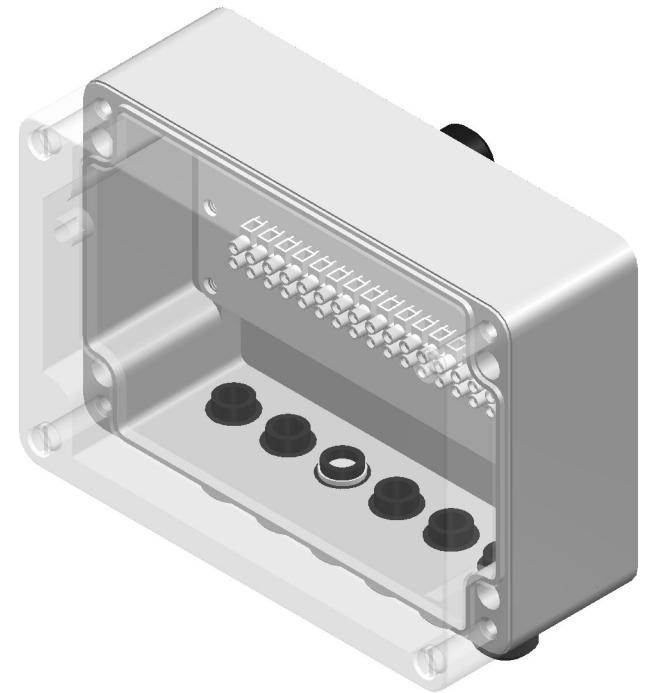
V1 IS A 3-WAY, 2-POSITION, SOLENOID OPERATED HYDRAULIC VALVE THAT IS INDEPENDENT OF THE NORMAL CONTROL MEANS FOR THE PC PUMP.  
 THE VALVE IS CONNECTED TO BY-PASS THE PUMP'S HYDRAULIC MOTOR WHEN IT IS DE-ENERGIZED.  
 PUSHING THE PUMPPRO RESET BUTTON WILL ENERGIZE THE VALVE AND ENABLE THE PUMP TO RUN.  
 ALARM TRIPS WILL DE-ENERGIZE THE VALVE AND HALT PUMP OPERATION.

SYSTEM SCHEMATIC DIAGRAM

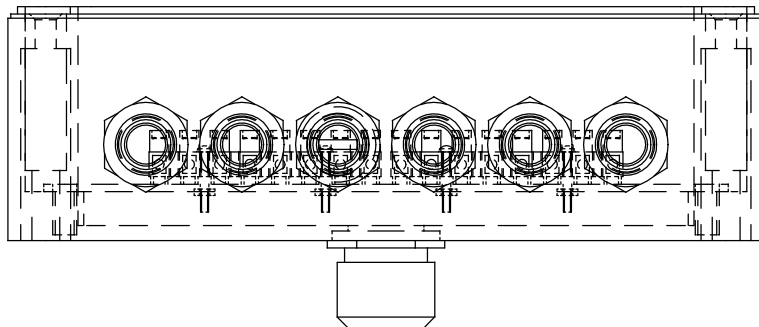
ITEM	DESCRIPTION	FUNCTION
R1	RESISTOR 499 OHM .25 WATT 1 %	CURRENT SENSING RESISTOR
S1	PUSHBUTTON SWITCH	RESET PUSHBUTTON
S2	PRESSURE SWITCH 275 PSI	HYDRAULIC PRESSURE SWITCH
S3	PRESSURE SWITCH 80 PSI	AIR PRESSURE SWITCH
V1	VALVE SOLENOID 3-WAY 2-POS	PUMP BY-PASS VALVE
X1	PRESSURE TRANSMITTER 4-20 mA	PRESSURE SENSOR
X2	TEMPERATURE TRANSMITTER 4-20 mA	TEMPERATURE SENSOR
X3	FLOW TRANSMITTER 4-20 mA	FLOW SENSOR

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	THIRD ANGLE PROJECTION			
TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X = + .100 DECIMAL .XX = + .020 DECIMAL .XXX = + .005 ANGULARITY = + .05 DEG	DRAWN <b>DCOLE</b> DATE <b>7/29/2005</b>	DWG NO <b>UPI015A10</b>	REV <b>2</b>	SIZE <b>C</b>
APPR		WEIGHT <b>38.8 lbm</b>	SHEET <b>4 OF 4</b>	

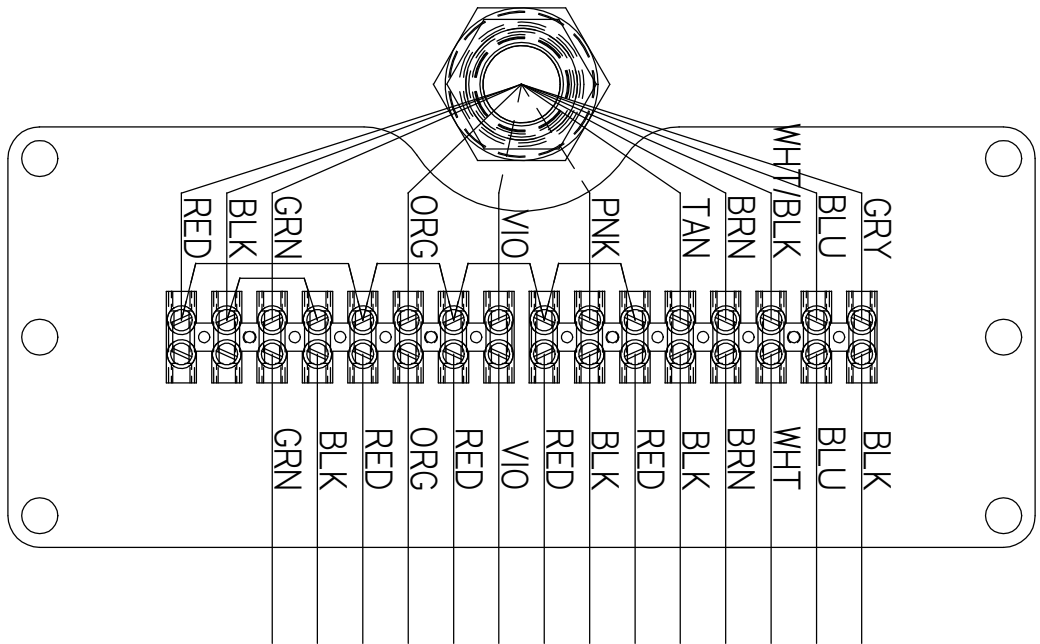


NOTE:  
 HALF PLUG USED IN PLACE OF  
 CONDUIT FITTING WHEN AIR  
 PRESSURE SWITCH NOT INSTALLED



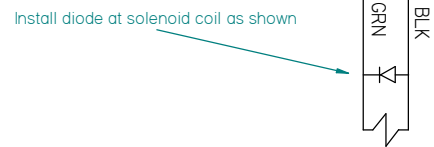
ITEM	QTY	DWG NO.	DESCRIPTION	Part ID
1*	1		DIODE SURGE SUPPRESSOR 51VIT-T1	231.0043
2	6		FITTING BODY HARNESSFLEX STRAIGHT NC12	231.6204
3	1		FITTING BODY HARNESSFLEX STRAIGHT NC16	231.6206
4	6		FITTING CAP NUT HARNESSFLEX NC12	231.6208
5*	1		FITTING CAP NUT HARNESSFLEX NC16	231.6209
6	6		FITTING SEALING BUSHING HARNESSFLEX NC12	231.6210
7*	1		FITTING SEALING BUSHING HARNESSFLEX NC16	231.6211
8*	1		FITTING LOCKNUT HARNESSFLEX M20 THRD	231.6213
9	6		FITTING SEALING WASHER HARNESSFLEX SWPG9	231.6214
10*	1		FITTING SEALING WASHER HARNESSFLEX SWM20	231.6215
11	1		HOLE PLUG HEYCO THREADED PG9	231.6240
12	2		TERMINAL STRIP 2-SCREW 8-POLE MOLEX	231.8171
13	4		NUT HEX #2-56 SS	950.9154
14	4		SCREW MACHINE SL ROUND HD #2-56X.625 SS	990.9154
15	1	UPI015A40	PUMPRO JUNCTION BOX ENCLOSURE	UPI015A40
16	1	UPI015P31	PUMPRO JUNCTION BOX TERMINAL BRACKET	UPI015P31

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TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X = +.100 DECIMAL .XX = +.020 DECIMAL .XXX = +.005 ANGULARITY = +.05 DEG		DRAWN: tbarham DATE: 4/26/2006 APPR:		TITLE: PUMPRO JUNCTION BOX ASSEMBLY DWG NO: UPI015A30 REV: 2 SIZE: C	
		WEIGHT: 0.0 lbm		SHEET: 1 OF 2	



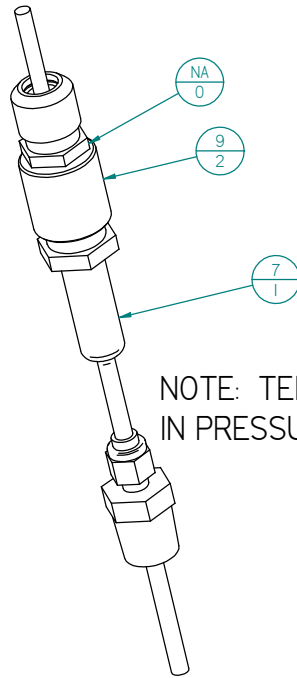
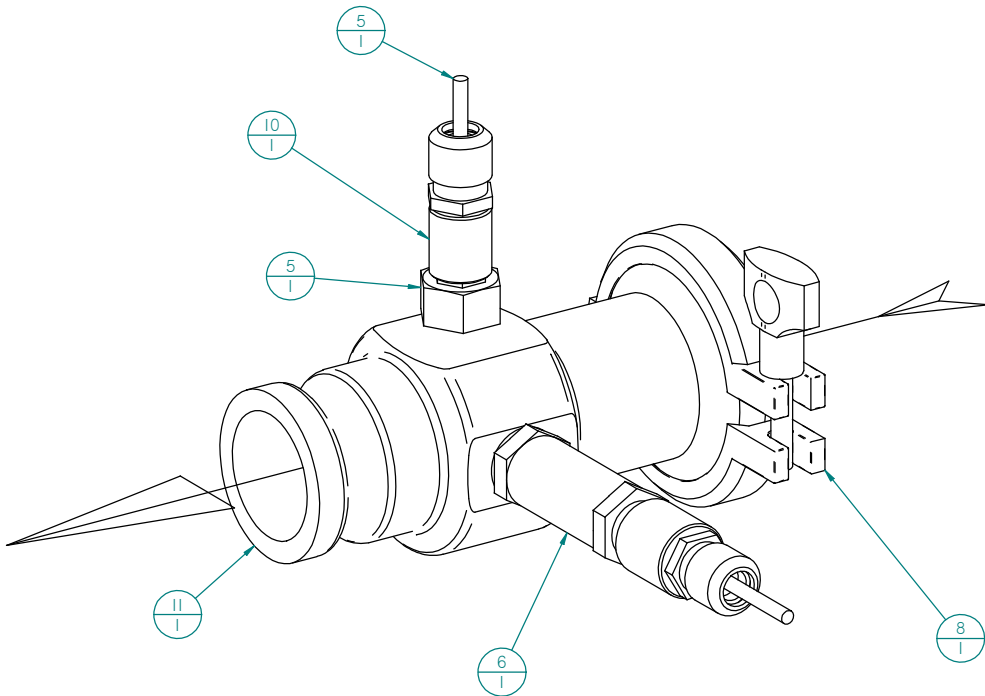
PUMP SOL    HYD SW    AIR SW    PRES XMTR    TEMP XMTR    FLOW SENSOR

NOTE: INSTALL JUMPER ACROSS TERMINALS FOR AIR SWITCH WHEN AIR SWITCH IS NOT INSTALLED.



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	 THIRD ANGLE PROJECTION	PROJECT TITLE <b>PUMPPRO JUNCTION BOX ASSEMBLY</b>	DWG NO <b>UPI015A30</b>
TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X = + .100 DECIMAL .XX = + .020 DECIMAL .XXX = + .005 ANGULARITY = + .05 DEG	DRAWN <b>tbarham</b> DATE <b>4/26/2006</b>	REV <b>2</b>	SIZE <b>C</b>
APPR	WEIGHT <b>0.0 lbm</b>	SHEET <b>2 OF 2</b>	

**\*\*IMPORTANT\*\***  
SEE EXPLODED DIAGRAM AND  
ALL NOTES ON OTHER SHEET

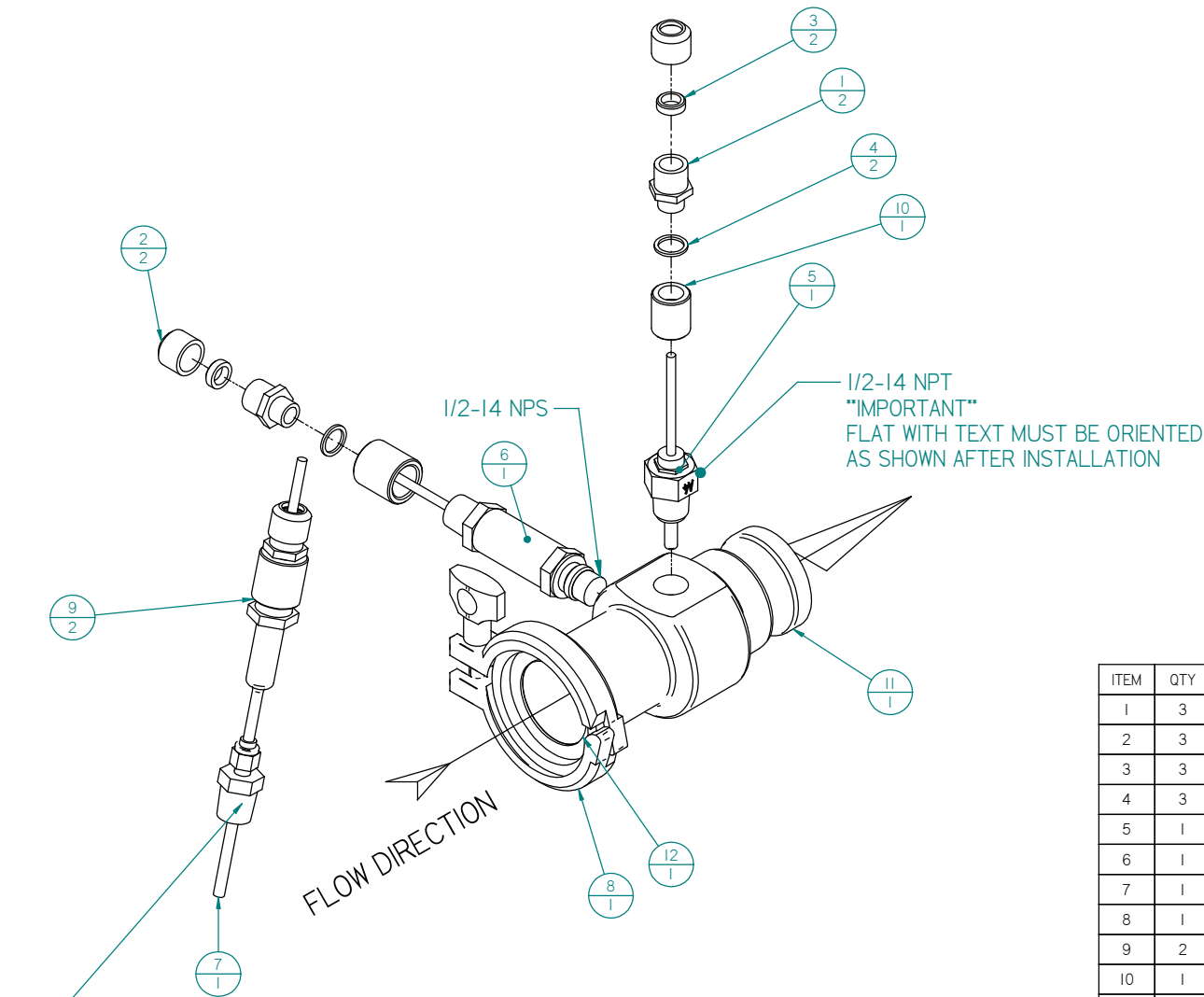


NOTE: TEMPERATURE TRANSMITTER INSTALLS  
IN PRESSURE PIPING AT PUMP OUTLET.

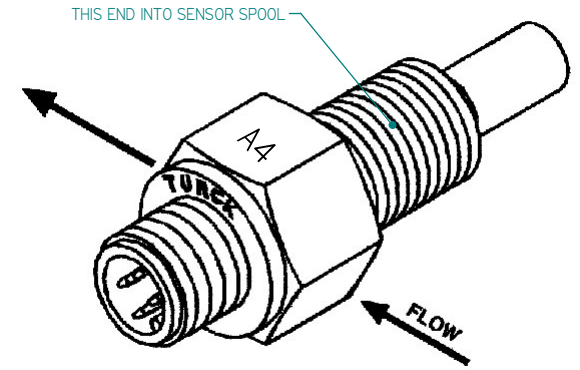
ITEM	QTY	DWG NO.	DESCRIPTION	Part ID
1	3		FITTING BODY HARNESSFLEX STRAIGHT NCI2	231.6204
2	3		FITTING CAP NUT HARNESSFLEX NCI2	231.6208
3	3		FITTING SEALING BUSHING HARNESSFLEX NCI2	231.6210
4	3		FITTING SEALING WASHER HARNESSFLEX SWPG9	231.6214
5	1		TURCK FLOW MONITOR FCS-NI/2A4-NA	231.8160
6	1		NOSHOK PRESSURE XMTR 622S-300-1-1-11-6	231.8162
7	1		KOBOLD TEMP XMTR TST-A4EPPV04C	231.8163
8	1		CLAMP I-LINE 2.5 SS IUSE W/UNIBORE 2 INI	279.8295
9	2	UPI015P01	ADAPTER .50 F-NPT X F-PG9 AL	UPI015P01
10	1	UPI015P02	COUPLING PG-9 AL	UPI015P02
11	1	UPI015P50	PUMPPRO SENSOR SPOOL UNIBORE 2 IN	UPI015P50
12	1	URI000P17	GASKET TEFLON UNIBORE 2 IN	URI000P17

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		PROJECT TITLE <b>PUMPPRO SENSOR ASSEMBLY UNIBORE 2 IN</b>		
TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X = + .100 DECIMAL .XX = + .020 DECIMAL .XXX = + .005 ANGULARITY = + .05 DEG	DRAWN <b>DCOLE</b>	DWG NO <b>UPI015A50</b>	REV <b>1</b>	SIZE <b>C</b>
DATE <b>1/24/2005</b>	APPR	WEIGHT <b>7.9 lbm</b>	SHEET <b>1 OF 2</b>	

NOTE: FITTINGS MUST BE INSTALLED IN LOCATIONS SHOWN  
 THREADS ARE SIMILAR BUT NOT THE SAME



NOTE: TEMPERATURE TRANSMITTER INSTALLS  
 IN PRESSURE PIPING AT PUMP OUTLET.



ALIGN FLOW SENSOR AS SHOWN  
 FLAT WITH TEXT MUST BE ORIENTED AS SHOWN  
 (TEXT MAY BE INVERTED)

ITEM	QTY	DWG NO.	DESCRIPTION	Part_ID
1	3		FITTING BODY HARNESSFLEX STRAIGHT NCI2	231.6204
2	3		FITTING CAP NUT HARNESSFLEX NCI2	231.6208
3	3		FITTING SEALING BUSHING HARNESSFLEX NCI2	231.6210
4	3		FITTING SEALING WASHER HARNESSFLEX SWPG9	231.6214
5	1		TURCK FLOW MONITOR FCS-NI/2A4-NA	231.8160
6	1		NOSHOK PRESSURE XMTR 622S-300-1-1-11-6	231.8162
7	1		KOBOLD TEMP XMTR TST-A4EPPV04C	231.8163
8	1		CLAMP I-LINE 2.5 SS IU5E W/UNIBORE 2 INI	279.8295
9	2	UPI015P01	ADAPTER .50 F-NPT X F-PG9 AL	UPI015P01
10	1	UPI015P02	COUPLING PG-9 AL	UPI015P02
11	1	UPI015P50	PUMPRO SENSOR SPOOL UNIBORE 2 IN	UPI015P50
12	1	URI000P17	GASKET TEFLON UNIBORE 2 IN	URI000P17

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		PROJECT: PUMPRO SENSOR ASSEMBLY UNIBORE 2 IN	
TOLERANCE LIMITS UNLESS OTHERWISE SPECIFIED DECIMAL .X = +.100 DECIMAL .XX = +.020 DECIMAL .XXX = +.005 ANGULARITY = +.05 DEG	DRAWN: DCOLE	DWG NO: UPI015A50	REV: 1 SIZE: C
	DATE: 1/24/2005		
THIRD ANGLE PROJECTION		SHEET: 2 OF 2	