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**Hypertherm<sup>®</sup>**

# HYPERTHERM SENSOR™ OHC AUTOMATED OXY HEIGHT CONTROL

## *OPERATION & SET UP GUIDE*



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**Making people and machines more productive through process *Automation***

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# Safety

## Read This Manual

Read and understand this instructional manual, the cutting machine manuals, and your employer's safety practices. **Note:** This product is not designed to be field serviceable. Please return to an authorized repair center for any required service.

## Dangerous Machinery



Operation and maintenance of automated equipment involves potential hazards. Personnel should take precautions to avoid injury.

Injury and entanglement may occur if hands and limbs come in contact with moving machinery.

KEEP HANDS CLEAR of dangerous moving machinery. All control, including manual, can be affected using the remote interface.

Loose fitting clothing or ties may become entangled in the machinery. These items should not be worn while operating or servicing the machine.

## High Voltages



Electric shock can kill. Be sure this equipment is safely installed in accordance with the enclosed procedures and specifications.

Avoid contact with electrical wires and cabling while power is on.

This equipment should only be opened by trained service personnel.

Please refer to the appropriate appendix in the Installation Guide provided with your control for details on safety certification for that product.



# Section 1: Overview

## Introduction

One of the most important parameters in Oxy Torch cutting is consistent torch tip to plate standoff distance. The Hypertherm Sensor OHC uses a capacitive sensor to measure the torch to plate distance. The unit will drive a DC motor on the torch lifter to automatically maintain a user selected torch to plate distance. This automatic closed loop control of the torch height will dramatically improve the cutting speed, quality and consistency.

The Sensor OHC includes the control unit, the capacitive sensor, sensor mounting isolator, sensor spring style breakaway, and standard 1 meter coax cable. A connector kit is available for the standard mating connectors. For demonstration purposes, a connector conversion kit is available that will make the unit plug compatible with the Burny AR 300/100 "Levigator Clearance Controller".

It is the installer's responsibility to provide a compatible lifter mechanism. A compatible lifter will utilize a 24Vdc motor between 2 Amps, 50 Watts and 6 Amps 150 Watts. The full speed operation must be geared to produce a linear full speed of between 20 in/ min (500 mm/min) and 140 in/min (3500 mm/min). The tradeoff being between a low speed extremely high accuracy lifter and a high speed lower accuracy lifter. The lifter should have adequate rigidity and very little backlash and moving inertia. The lifter should also have normally closed upper and lower limit switches mounted at the extremes of travel.

The installer must also provide an appropriate mounting clamp that will attach the 20 mm diameter sensor mounting isolator to the torch. The mounting clamp should be designed for a center of torch to center of isolator distance of 2 inches or 50mm so that that the sensor ring will be properly centered and positioned around the torch tip. Additionally, the mounting clamp should provide a good electrical ground connection to the overall machine frame and to the metal plate being sensed. Failure to provide an adequate ground connection to the plate will have a negative effect on the height measurement and control accuracy.

<b>Main Power Supply:</b>	<b>24Vac +/- 10%, 50, 60 Hz</b>
<b>Compatible Lifter Motors</b>	<b>DC shunt, 24Vdc, 2 Amps to 6 Amps</b>
<b>Max Power Output</b>	<b>150 Watts</b>

## Description and Features

SENSOR™ OHC - Oxy Height Control is an advanced automated height control system for oxy fuel shape cutting applications. This product utilizes advanced capacitive sensing and microprocessor technology to automatically detect the plate and adjust torch position to a desired set point during oxy fuel cutting operations. This reduces operator input, improves accuracy and increases productivity.

### Features

- Sensor OHC can be used with any CNC
- Easy setup & operation
- Both manual & automatic operation modes
- Microprocessor control for increased sensitivity and control
- High positioning speeds possible with up to 6 amps continuous current and linear adjustment over full range
- Built-in diagnostic and fault detection features
- Auto retract on plate contact
- Optional second height set point input for preheat or pierce
- Indicator lights for operation including:
  - ⇒ Power On
  - ⇒ Upper Limit Switch
  - ⇒ Lower Limit Switch
  - ⇒ In Position Indicator
  - ⇒ Attention / Error indicator

### Options

- Five Cable Lengths from 19.7" (500mm) to 59" (1500mm)
- Adapter cables allowing direct replacement for existing AR-300/100W Levilator Clearance Controls

## System Features\*

Compatible Motors	DC shunt 24VDC, 2 Amps to 6 Amps ( customer supplied )
Max Power Output	150W
Control Range	Linear 0.1" (2.5mm ) to 1.0" (25mm)
Motor Output	Full "H" bridge PWM with current sensing
Accuracy	.01" (.25mm )**
Operator controls	Easy to use control set point knob and easy read indicators
Calibration	Easy access calibration pot on front Panel
Measuring Technology	Capacitive Ring with Coax Cable
Dimensions	8.50" (216mm ) W x 4.21" (107mm) D x 4.02" (102mm) H
Inputs/ Outputs	3 outputs and 6 inputs optically isolated on "D" connectors
Weight	2.4 lbs
Operating Environment	0 to 50C; 95% relative humidity (non-condensing)
Power	24VAC +/- 10% 50/60 Hz

\*Information subject to change without notice.

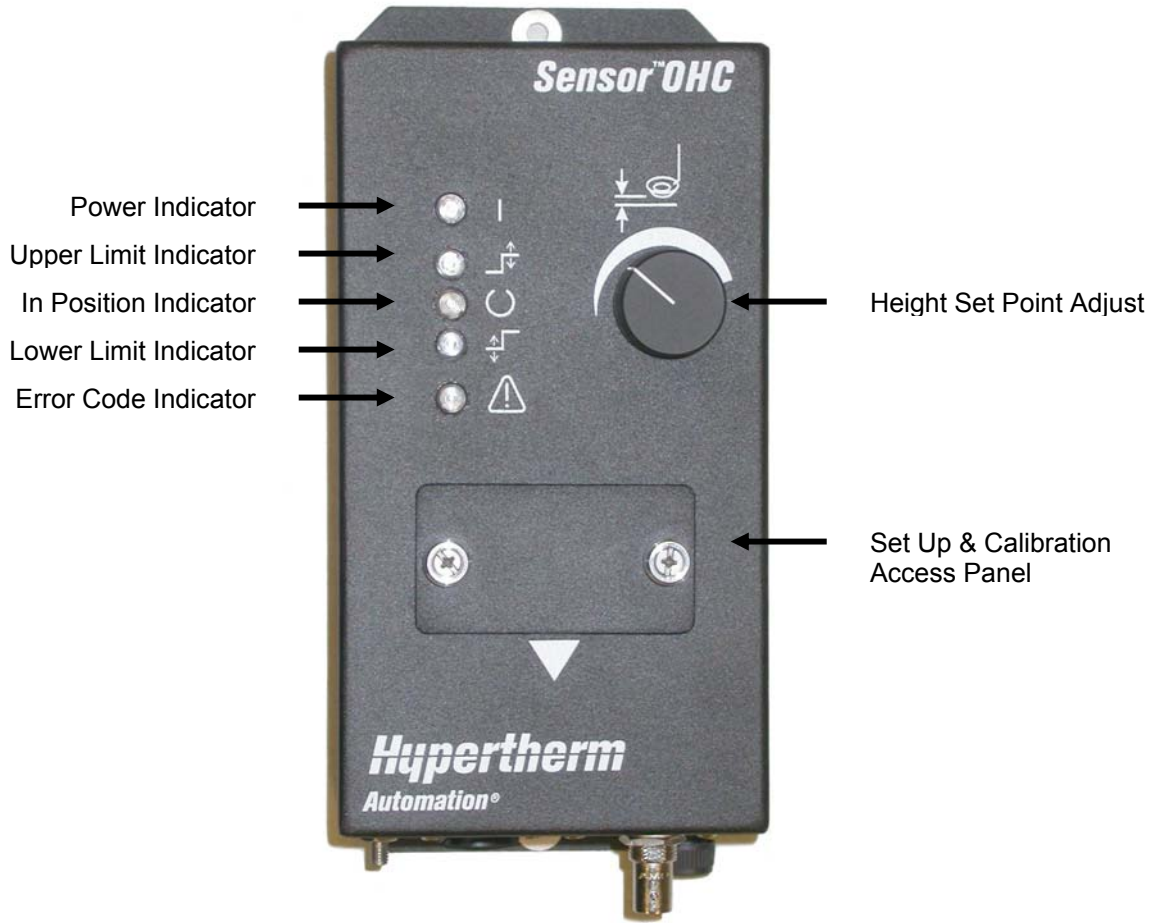
\*\* Dependent on customer supplied lifter mechanics



**Hardware Specifications**

Main Power Supply:	24 Vdc +/- 10%, 50/60 Hz	
Compatible Lifter Motors:	DC shunt motor 24Vdc, 2 Amps to 6 Amps	
Operating Temperature:	0 to +50 deg C	
Control Range: (standard sensor & cable)	Linear 0.1 inch to 1.0 inch (2.5 to 25 mm)	
Height Measuring Technology:	Capacitive Ring with Coax Cable	
Accuracy: (dependent on lifter mechanics)	0.01 inch (0.25 mm) w/ representative Lifter	
HF Coax Cable:	500 mm to 1500 mm (1000 mm standard)	
Standard Sensor:	Stainless Steel Ring 100 mm outer & 50 mm inner diameters. Can be calibrated for others	
Dimensions:	8.50" (216mm) W x 4.21" (107mm) D x 4.02" (102mm) H	
Control Type:	Digital Micro Processor based	
Motor Output:	Full "H" Bridge PWM with current sensing	
Control Interface:	Optically Isolated I/O on "D" connectors	
Outputs:	Digital In-Position Output Digital Error Output Digital Plate Contact Output	
Inputs:	Digital Manual/Auto Select Digital Manual Up Digital Manual Down Digital Upper Limit Switch Digital Lower Limit Switch Digital Second Height Select Remote Height Set-point Pot Second Height Set-point Pot	
Front Panel Indicators	green yellow green yellow red	Power Upper Limit Switch In Position Lower Limit Switch Attention/Error Code

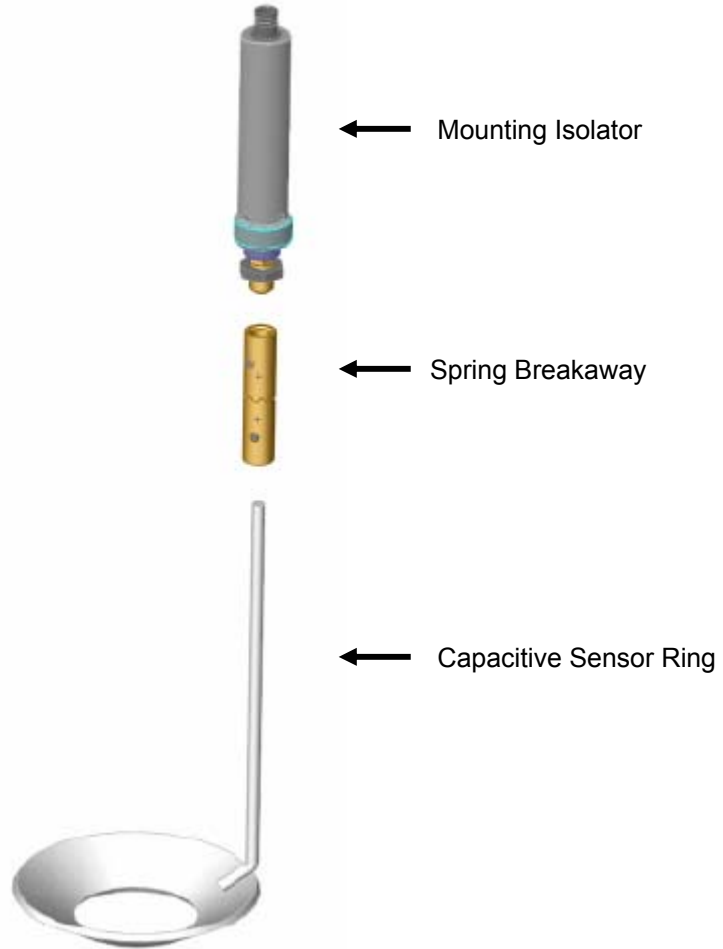
### Control Unit Front



## Control Unit Bottom



### Sensor and Mounting Isolator



## ***Section 2: Operation***

### **Operation Modes**

The two basic modes of operation are “Automatic” and “Manual”.

Note: The control unit must be calibrated prior to use. See calibration instructions in this guide.

#### **Automatic Operation**

“Automatic” mode is active whenever the “Manual” input on pin-3 of the 15 pin I/O connector is open. During “Automatic” operation, the height of the torch is constantly maintained at the set height. When the unit is operating, the green “In-Position” front panel light and corresponding I/O output will indicate that the unit is maintaining the set height. At any time during “Automatic” operation the set height can be changed and the unit will quickly respond and position to the new desired height. The ‘Up/Down’ switch can be used at any time to temporarily override automatic operation and force the lifter to move in the desired direction. As soon as the Up/Down switch is released, the unit will return to automatic operation. Activation of either limit switch will prohibit further motion in that direction.

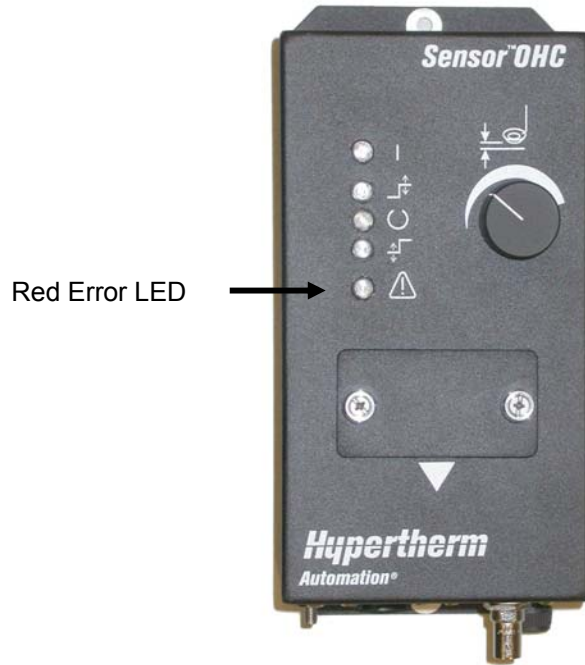
#### **Manual Operation**

“Manual” mode is activated by connecting the input on pin-3 of the 15 pin I/O connector to the signal Ground on pin-2. In manual mode, the unit is controlled by using the Up/Down switch only. The control will not respond to the “Set Height” and will stay fixed in the position that it was last driven to using the Up/Down switch. The Up/Down switch has two speeds depending on how long it is held active. During the first second, the control will move at low speed to allow the operator to finely position the torch. The low speed can be maintained by pulsing the Up/Down switch. If the Up/Down switch is maintained for more than one second, then the control will shift to full speed to drive the lifter in the desired direction. Activation of either limit switch will prohibit further motion in that direction.

#### **Errors**

During “Automatic” operation mode, if the sensor should come too close to the plate (less than 1/10 inch or 2.5 mm), the unit will automatically force a retract in an attempt to avoid a crash. This error condition and others listed in the following figure will be indicated by a code number that flashes on the red “Error” front panel light. Any error will also cause the “Error” output on the I/O connector to become active until the error is corrected.

## Error Conditions



### Error Indications

The red ERROR LED indicates abnormal conditions by flashing an error code. The error code meanings are listed below.

#### 1 Flash - Sensor Shorted Error

Indicates that the sensor is in contact with the plate. In Auto Height mode, this will cause a rapid retract until the sensor no longer is in contact with the plate. This may also indicate that re-calibration is required

#### 2 Flashes - Sensor Open Error

Indicates that the sensor is not plugged in or the sensor cable has opened. In Auto Height mode, this error will disable all motion. This may also indicate that re-calibration is required

#### 3 Flashes - Input Voltage Low

Indicates that the 24Vac power source has dropped more than 25% below nominal. Check the power source and all connections.

#### 4 Flashes - Input Voltage High

Indicates that the 24Vac power source is more than 20% high and may cause damage to the unit.

#### 5 Flashes - Motor Drive Over Temp Warning

Suspend operation and allow unit to cool down.

#### 6 Flashes - Invalid data in the selected cable length data table.

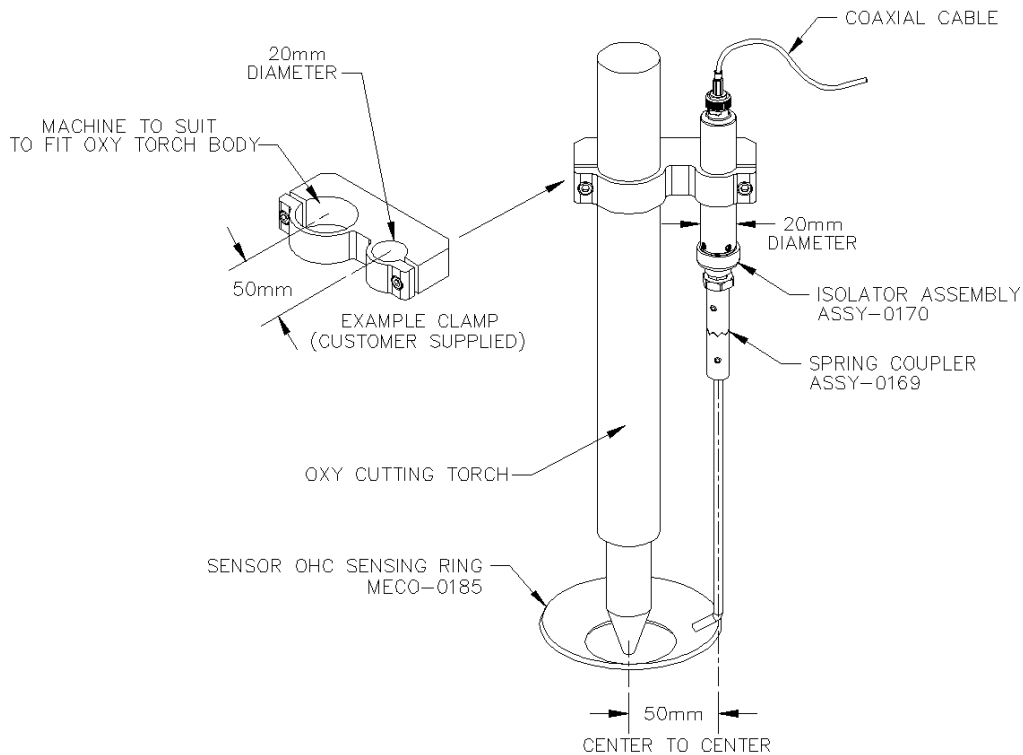
Set DIP switches 1 thru 3 to a valid cable length setting.

## Section 3: Installation and Set Up

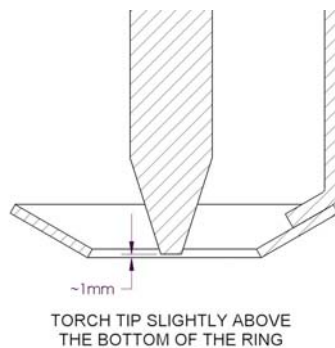
### Installation

#### Sensor Mounting

The sensor connection is thru the coax cable to the sensor mounting isolator. It is the responsibility of the installer to provide a mounting clamp that will correctly position the sensor ring with respect to the torch tip. The mounting clamp should be designed for a center of torch to center of isolator distance of 2 inches or 50mm so that the sensor ring will be properly centered and positioned around the torch tip. Additionally, the mounting clamp should provide a good ground electrical connection between the sensor mounting isolator and the machine frame.



#### Sensor Position to Torch



### Connectors

Wire the unit as shown with reference to the following figures. A standard mating connector kit is available which provides the mating 9 pin & 15 pin "D" type connectors and the 7 pin circular power connector (CONN-0141). Also available for drop-in demonstration purposes is a connector conversion kit that will adapt the unit to AR300/100 style connectors (CABL-0163). It is recommended that you use the AR300/100 conversion kit for demonstration purposes only. Use of the plastic housings on the AR300/100 style connectors does not allow for proper cable shielding. Improper cable shielding can result in severe electrical interference problems.



### Power Connections

All power connections are made to the 7 pin circular connector. When connecting to the motor, ensure that the motor polarity is such that if pin 2 is positive with respect to pin 5 the slide will move in the UP direction. The 24 Vac power source is connected between pins 3 and 6. Pin 4 is connected internally to the grounding stud on the enclosure and the ground stud should be connected to the machine chassis.

### 24VAC Input / Motor Pinout

7 Pin Amp Connector

Pin	Description
3	24VAC
6	24VAC Return
4	Ground
2	Motor
5	Motor



**Limit Switch**

The lifter upper and lower limit switches are connected to the 9 pin “D” connector. These switches are normally closed switches that open when the limit is reached. The upper limit switch connects between pins 5 & 6 and the lower limit switch connects between pins 2 & 3. This connector also provides limited +12 Vdc on pins 1 & 4 that can be used to power either optical or hall-effect limit switches.

**Limit Switch Pinout**

9 Pin D-Sub

Pin	Description
2	Lower Limit ( contact closure )
3	Lower Limit ( contact closure )
5	Upper Limit ( contact closure )
6	Upper Limit ( contact closure )

**Digital I/O**

The digital I/O interface on the 15 pin “D” connector should include a switch to select between manual and automatic operation. This switch connects from the input on pin 3 to the signal return on pin 2. When this switch is closed, the unit will operate in manual mode. The digital I/O interface also needs a three position center off momentary Up/Down switch to operate in manual mode or manual override in automatic mode. When the input on pin 4 is connected to the signal return, the slide will be driven up; and when the input on pin 5 is connected to signal return, the slide will be drive down. The “Second height Select” input on pin 6 is used to select a second height set-point from an optional external pot. The optional status output signals “In-Position”, “Error” and “plate Contact” are available on pins 7 , 8 7 9 respectively. The outputs are transistors connected to signal return and are capable of switching up to 30V at 100 mA each. A source of +12V dc is available on pin 1, for use in interfacing to the output signals. Care should be taken that the total +12 Vdc current drawn from pin 1 plus the current drawn from pins 1 & 4 of the 9 pin “D” connector, does not exceed 50 mA.

**Optional External Height Set Pot**

An optional 10K pot can be connected between pins 10 & 11 to allow external setting of the automatic height set-point. This pot will work in conjunction with the unit’s front panel height setting pot and both will affect the height set-point. The control unit front panel set pot and the external set pot are electrically in parallel. This will cause some non-linearity in the height set point. Usually the front panel control is used as the coarse adjustment and the external pot will provide a fine tuning of the set point.

**Optional External Second Height Set Pot**

An optional 10K pot can be connected between pins 12, 13, & 14. This pot will provide an active height set-point whenever the digital “Second Height Select” input is switched active by connecting the input on pin 6 to the signal return on pin 2. Unlike the external pot for normal height set point, this pot will completely override the control front panel height set point. This external point will provide a linear adjustment of height vs. set point

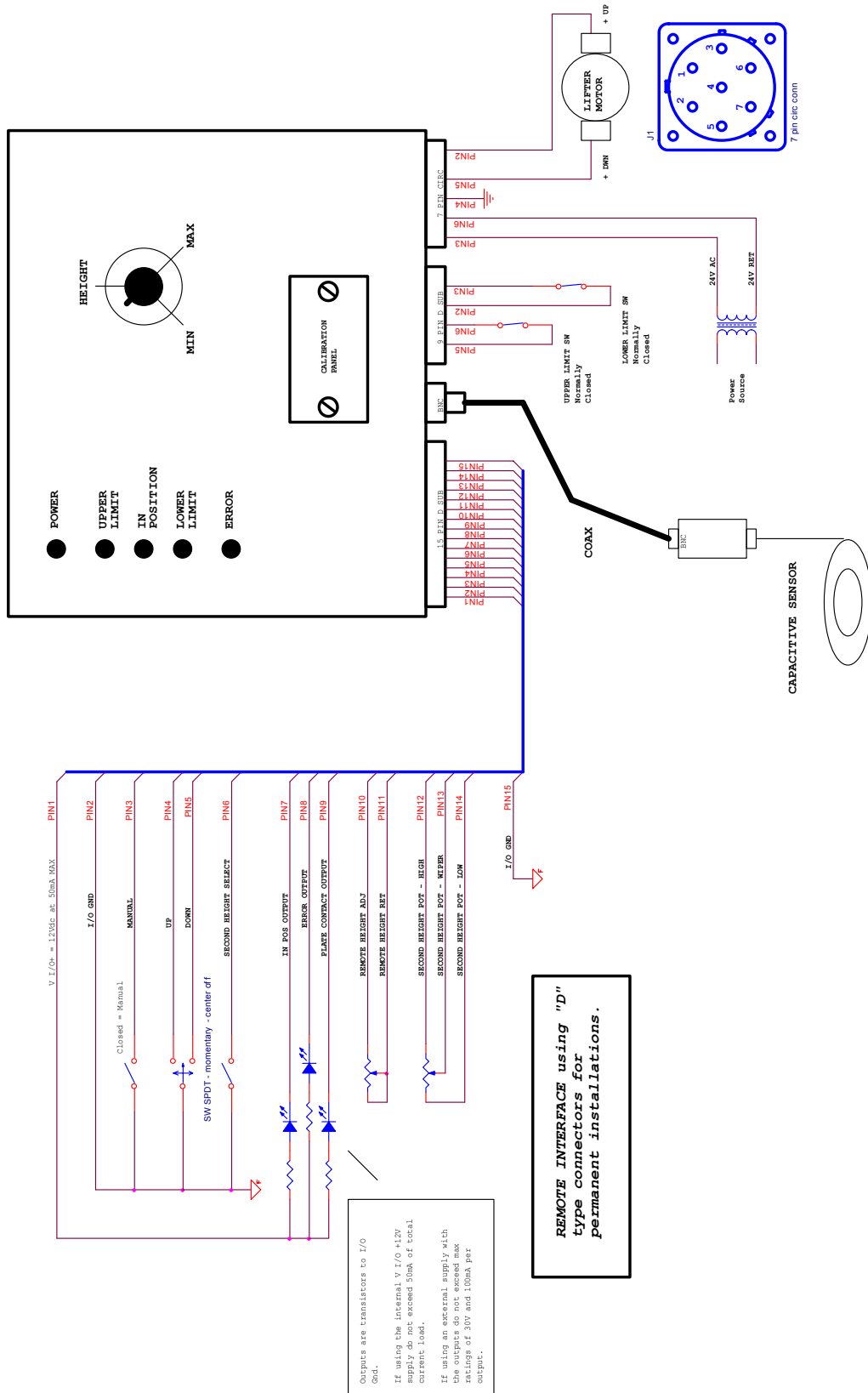
This second external height set point could be useful to provide an independent pierce or preheat height. By using the digital input "Second Height Select", it is possible to rapidly switch between normal height and second height while in motion. Another use for the second set height would be to effectively disable the control unit front panel height set point pot. This would allow for central control of cutting height and eliminate the possibility of accidental errors due to the unintentional changing of the control front panel height set point pot.

### **I/O and Control Pot Pin out**

15 Pin D-Sub

<b>Pin</b>	<b>Description</b>
1	I/O Power 12VDC at 50Ma Max
2	I/O Ground
3	Manual Select Input
4	Up Input
5	Down Input
6	Second Height Select Input
7	In Position Output
8	Error Output
9	Plate Contact Output
10	Remote Height Adjust Pot
11	Remote Height Adjust Return
12	Second Height Pot High
13	Second Height Pot Wiper
14	Second Height Pot low
15	I/O Ground

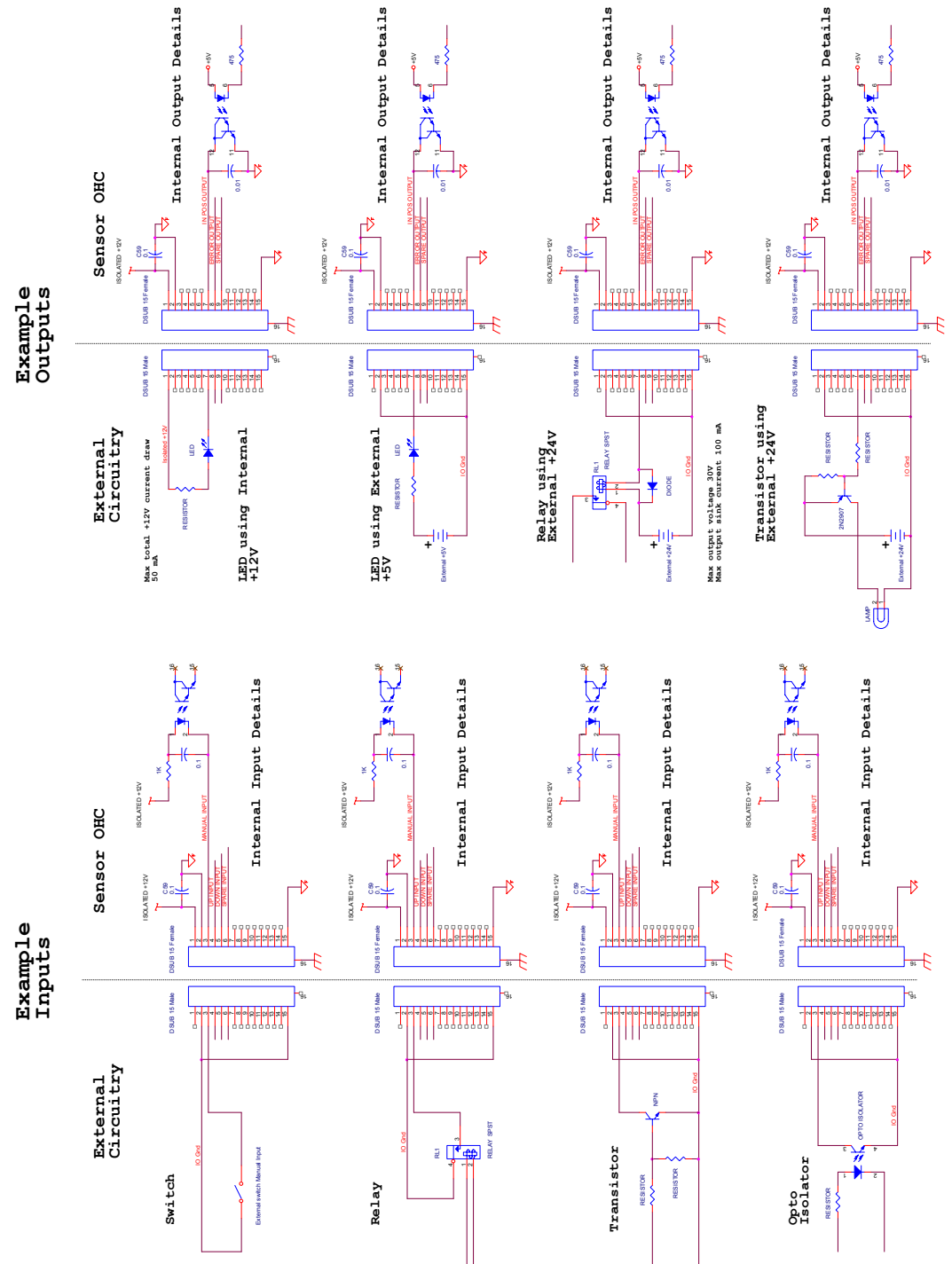
Standard Wiring Installation



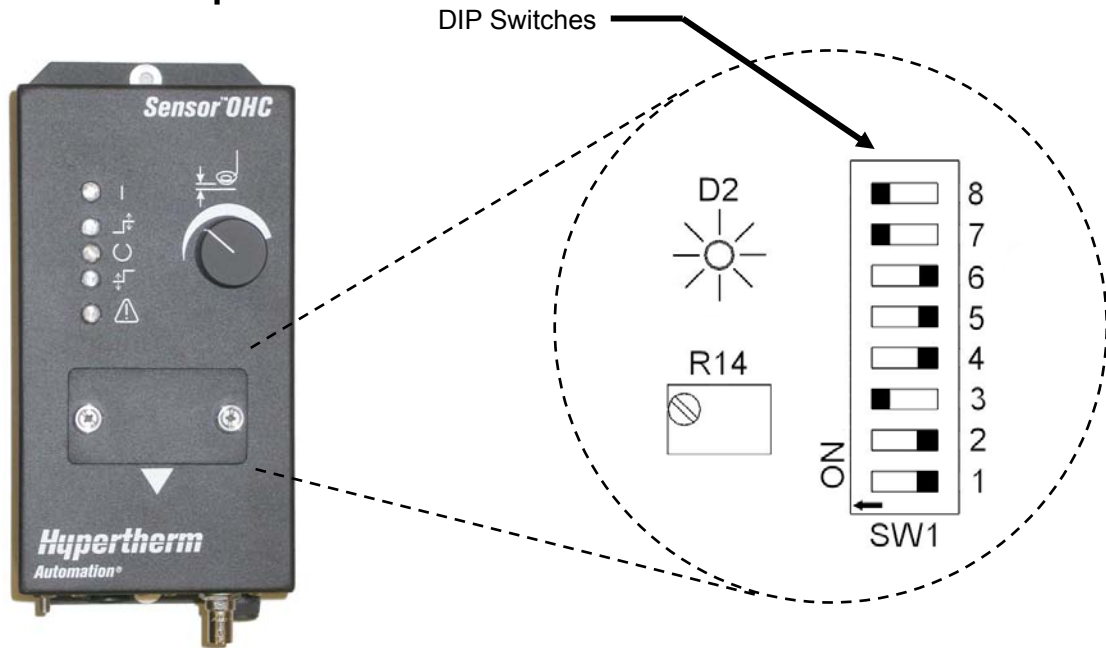
# IO Interfacing

The attached figure shows the details of connecting the IO to external switches, relays, transistors, and other circuitry. The figure shows examples using the available isolated +12V source and using an external voltage source.

## IO Interfacing Examples



## DIP Switch Setup



<b>SW1</b>	<b>SW2</b>	<b>SW3</b>	<b>Sensor Cable Length</b>
on	on	on	cable length = 500 mm
off	on	on	cable length = 800 mm
on	off	on	cable length = 900 mm
off	off	on	cable length = 1000 mm *
on	on	off	cable length = 1200 mm
off	on	off	cable length = 1500 mm

<b>SW4</b>	<b>In Position Output in Manual Mode</b>
off	Normal - active output near height set point*
on	Forced active - always active in Manual Mode

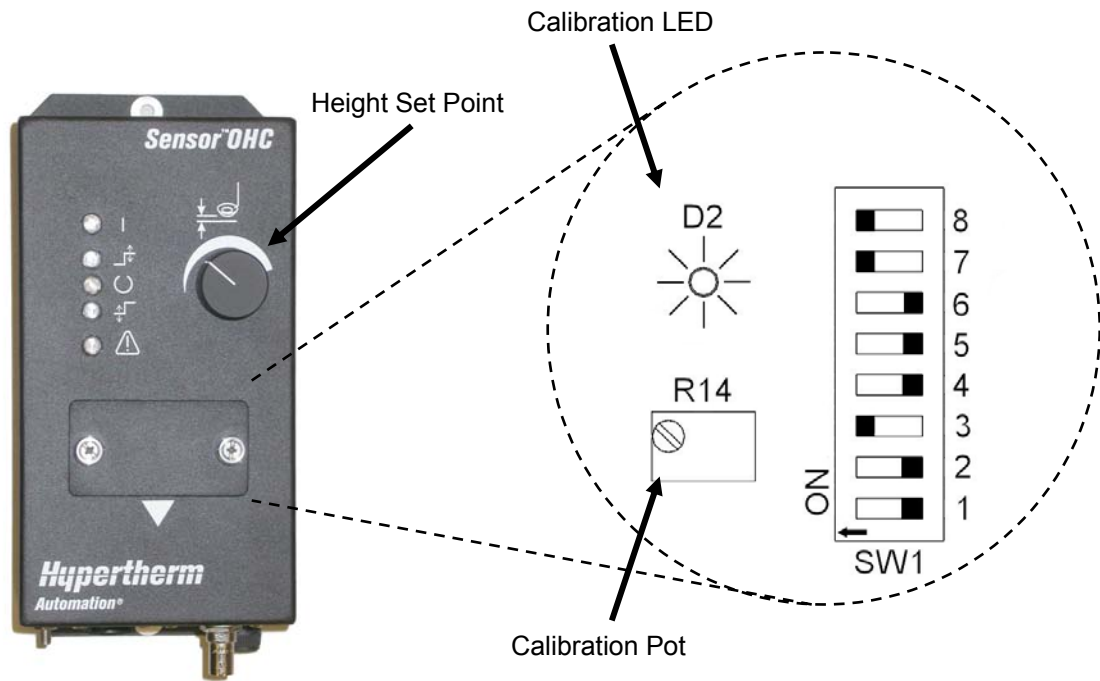
<b>SW5</b>	<b>SW6</b>	<b>Sensitivity &amp; Loop Gain</b>
off	off	Sensitivity lowest - Lowest Gain Most Stable / use for high speed lifters ( > 3000 mm/min )*
on	off	Sensitivity medium low
off	on	Sensitivity medium high
on	on	Sensitivity highest - Highest Gain Least Stable / use for low speed lifters ( < 750 mm/min )

<b>SW7</b>	<b>SW8</b>	<b>Max Motor Current</b>
off	off	Current lowest = 2.0 Amp 50W
on	off	Current medium low = 3.0 Amps 75W
off	on	Current medium high = 4.0 Amps 100W
on	on	Current highest = 6.0 Amps 150W*

\* Indicates setting as shipped.

NOTE: The RJ45 connector under the calibration panel is not a network connection. It is a proprietary connector and is for the use of authorized service personnel only.

## Calibration Procedure



### Calibration Instructions

- 1) Install the torch and sensor ring with torch tip aligned with the bottom edge of the sensor. Ensure that all DIP switches are correctly set for cable length, lifter speed, and sensitivity, and max motor current (see DIP Switch Set Up).
- 2) Set the unit for Manual operation and then apply power to unit.
- 3) Position the sensor ring above the plate. Use the UP/DOWN switch to **raise the sensor ring at least 100 mm or 4 inches above the plate.**
- 4) Remove the Calibration Panel and adjust the CALIBRATION POT. When adjusting the calibration, check that nothing abnormal is in the vicinity of the sensor ring. This includes the person who is performing the calibration. The CALIBRATION LED should remain flashing even when the screwdriver is removed from the CALIBRATION POT.

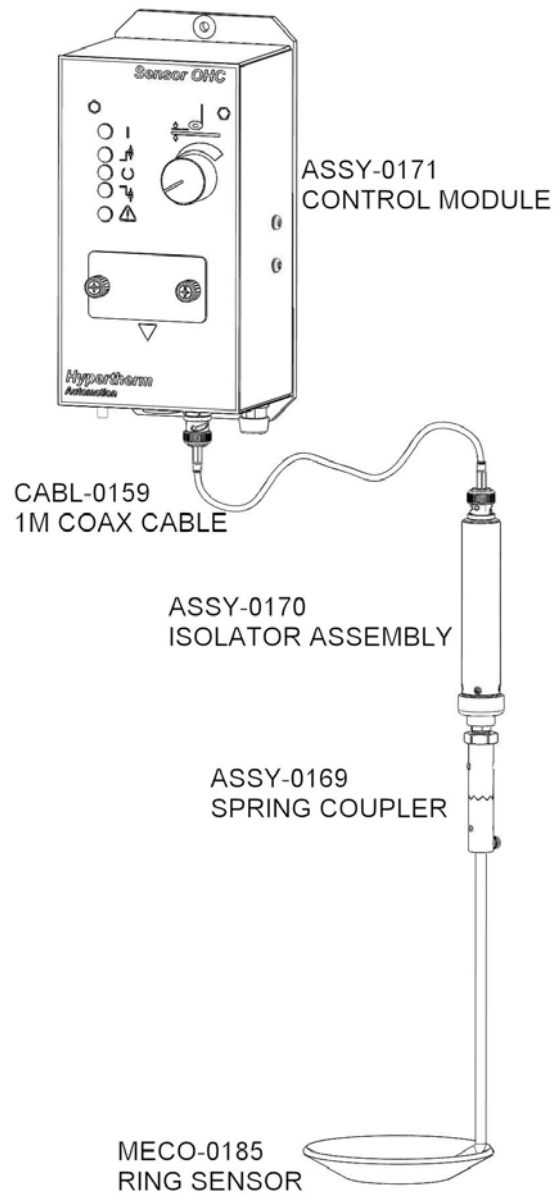
If the CALIBRATION LED is OFF, then rotate the pot clockwise (CW) until the LED is flashing.

If the CALIBRATION LED is ON, then rotate the pot counter clockwise (CCW) until the LED is flashing.

- 5) Check the Calibration - Set the Height Set Point to MAX and place the unit into the AUTO mode. The sensor should be stable about 1 inch or 25mm above the plate. Adjust the Height Set Point to MIN. The sensor should now be about 1/10 inch or 2.5 mm above the plate.

NOTE: The RJ45 connector under the calibration panel is not a network connection. It is a proprietary connector and is for the use of authorized service personnel only.

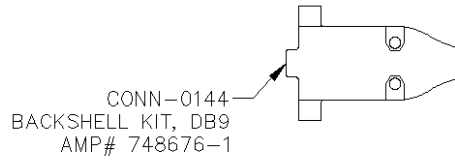
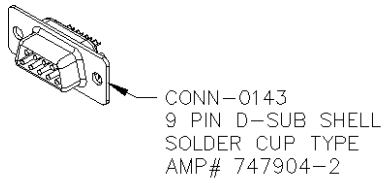
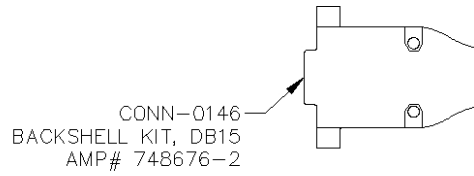
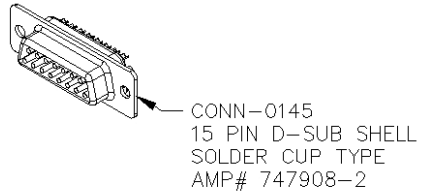
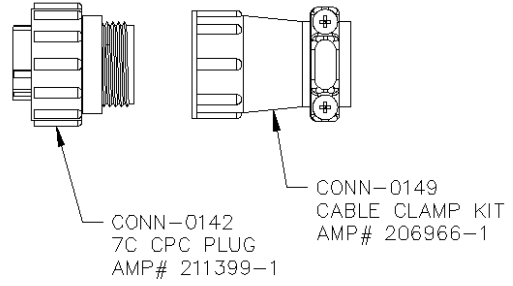
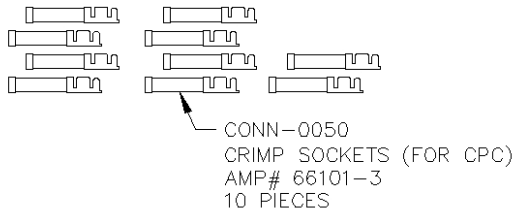
## Component List



### Optional Sensor Cables

<u>Part Number</u>	<u>Description</u>
CONN-0141	MATING CONNECTOR KIT
CABL-0163	AR-300/100 CONVERSION ADAPTER CABLE
CABL-0157	COAX CABLE, 0.5M
CABL-0158	COAX CABLE, 0.8M
CABL-0159	COAX CABLE, 1.0M
CABL-0160	COAX CABLE, 1.2M
CABL-0161	COAX CABLE, 1.5M

**Connector Kit (CONN-141) Components**







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