Roboworld ECU Installation and Operating Instructions

328-series

6800-BTU Heating Capacity 6000-BTU Cooling Capacity



Roboworld ECU

Mounting Options



On-Robot mount



Floor/Cabinet mount



Wall/Cage mount

Roboworld ECU

"On-Robot" Mounting Plate Examples



Roboworld does not supply nor specify bracketry required to mount the ECU. Source/Mfg locally. Shown mounted to Motoman MPL160 peripheral mounting pad near S-axis

External Overview



Lower Cabinet Components



WARNING: Electrically ISOLATE the ECU <u>before</u> opening the lower cabinet.

Lower Cabinet Major components:

- 1) Blower Motor (runs continually)
- 2) Terminal Block
- 3) Heater Coil (2000W)
- 4) Thermostats (qty-2)
- 5) Pneumatic Supply Solenoid (to Vortec)
- 6) Return Air PVC port

Lower Cabinet Components



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Upper Cabinet Components



WARNING: Electrically ISOLATE the ECU <u>before</u> opening the upper cabinet, as the blower motor fan operates continually.

Upper Cabinet Major components:

- 1) Vortec Tube
- 2) Blower Motor Fan
- 3) Vortec Cold Fraction Valve
- 4) Vortec Muffler threaded valve body
- 5) Conditioned Air PVC Port (to suit)

Schematic

WARNING: Electrically ISOLATE the ECU <u>before</u> opening the cabinet.



Initial Settings

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There are 3 settings which must be adjusted prior to placing the ECU into operation:

- 1) Low Temperature Threshold
- 2) High Temperature Threshold
- 3) Cooling Fraction (see page 14)

The Low Temperature setting determines when current is applied to the 2kW heating coil, allowing the ECU to generate hot air. This is adjusted on the thermostat marked "HEATER" in the lower portion of the ECU cabinet. **Roboworld recommends setting the HEATER thermostat to 40F.**

The High Temperature setting determines when the pneumatic solenoid opens and delivers compressed air to the Vortec tube, producing cold air. This is set on the thermostat marked "COOLER" in the lower portion of the ECU cabinet. **Roboworld recommends setting the COOLER thermostat to 90F**.

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The Low Temperature setting determines when current is applied to the 2kW heating coil, generating hot air. **Roboworld recommends setting the HEATER thermostat to 40F.**

The High Temperature setting determines when the pneumatic solenoid opens and delivers air to the Vortec cooler. **Roboworld recommends setting the COOLER thermostat to 90F.**



Initial Settings--SUMMARY

The blower motor is designed to run CONTINUALLY.

The blower will circulate HEATED AIR when the return suit temperature DROPS BELOW the HEATER set temperature.

The blower will circulate COLD AIR when the return suit temperature RISES ABOVE the COOLER set temperature.

The blower will circulate AMBIENT AIR when the return suit temperature is between the HEATER and COOLER temperatures.

EXAMPLE: When using recommended thermostat settings, HEATED AIR is circulated when return air temperatures (from the suit) drop below 40F. AMBIENT AIR is circulated between 41F and 89F. At return air temperatures (from the suit) above 90F, the ECU circulates COLD AIR.

Vortec Operation—Preparing Pneumatic Connections

The Vortec tube provided in this kit is rated at 3000BTU's cooling capacity. The tube will consume 50 scfm of air (when compressed air input is 100 psig and the hand operated globe valve is adjusted to produce the maximum cooling capacity). The globe valve regulates the flow and temperature of the cold air.

The compressed air must be regulated, free of oil, and filtered to remove particulate greater than 5 microns. A compressed air dryer is strongly recommended in humid environments. Hot air produced by the Vortec tube is exhausted to the environment through a muffler.

ALL connections from the compressor to the Vortec tube must be sized ½" (ID) <u>or larger</u>. Pay particular attention to the internal diameter of any valve, regulator, and/or quick disconnect fitting.

Note: If a coupling, regulator, and/or hose/pipe smaller than ½" (ID) is used anywhere downstream from the compressor—you will reduce the cooling capacity of the tube by restricting flow to the (Vortec) turbine. A dedicated regulator and shut-off value is recommended between shop air (source) and the Vortec tube. Use of a dryer is recommended in humid locations.

Vortec Operation—Shop Air Routing/Connections



The "flow factor" (Cv) of any component (valve, regulator, etc.) should be no less than 4.0.

Vortec Operation—Initial Set-Up

Begin by CLOSING the globe valve. Orient the ECU as shown below, and rotate in the direction of the arrow until the valve is completely seated/closed.

Place a reference mark on the handle at the 6-O'Clock position.





Note that the valve is fully seated against the brass valve body

Vortec Operation—Initial Set-Up

Annotate the brass valve body "COLDER" (in the direction of the arrow cast into the valve body).

This will help determine the correct direction you must rotate the valve in order to achieve the desired temperature corrections (warmer or colder) in future steps.



Vortec Operation—Initial Set-Up

The Vortec tube is infinitely adjustable. The setting shown at the right is the approximate (factory) position to achieve maximum temperature-drop.

You may elect to set a specific temperature by adjusting the valve open (warmer) or closed (cooler).

Alternatively, you may adjust the valve to achieve specific flow rates.

To LOWER TEMPERATURE (or decrease flow), turn the globe valve IN THE DIRECTION of the arrow cast into the brass valve body.

To **RAISE TEMPERATURE** (or increase flow), turn the globe valve **OPPOSITE THE DIRECTION** of the arrow cast into the brass valve body.





Cold Fractions

The table below shows approximate temperature drop and rise achieved by vortex tubes when adjusted to various Cold Fractions. Cold Fraction is the percentage of cold air produced versus total filtered compressed air consumed by any Vortex Tube.

Numbers on White Bar: Temperature Drop

Numbers on Blue Bar: Temperature Rise

COLD FRACTION	10		20		30		40		50		60		70		80		90	
PSIG/BAR	F°	C°	F°	C°														
20/1.4	63	35	62	34	60	33	56	31	51	28	44	24	36	20	28	15	17	9
	7	4	15	8	25	14	36	20	50	28	64	36	83	46	107	59	148	82
40/2.8	91	51	88	49	85	47	80	44	73	41	63	35	52	28	38	21	29	14
	9	5	21	11	35	19	52	29	71	39	92	51	117	65	147	82	220	122
60/4.1	107	59	104	58	100	56	93	52	84	47	73	41	60	33	45	25	29	16
	10	6	24	13	40	22	59	33	80	44	104	58	132	73	168	93	236	131
80/5.5	119	66	115	64	110	61	102	57	92	51	80	44	66	36	49	27	31	17
	11	7	25	14	43	24	63	35	86	48	113	63	143	79	181	101	249	138
100/6.9	127	71	123	68	118	66	110	61	99	55	86	48	71	39	53	29	33	18
	12	8	26	14	45	25	67	37	91	51	119	66	151	84	192	107	252	140
120/8.3	133	74	129	72	124	69	116	64	104	58	91	50	74	41	55	31	34	19
	13	8	27	14	46	26	69	38	94	52	123	68	156	87	195	108	257	142
140/9.7	139	78	135	75	129	72	121	67	109	61	94	52	76	42	57	32	35	20
	14	8	28	16	47	27	71	39	96	53	124	69	157	88	196	109	259	144

Table Baseline:

Compressed air Temperature: 70°F / 21°C

Pressure Dew Point: -25°F / -32°C

Compressed Air Pressure: 100 psig (6.9 bar)

 Backpressure: Temperature drops and rises in the chart are based on zero (0) backpressure on the hot and cold outlets of the vortex tube. Backpressure exceeding 5 psig (0.3 bar) will reduce the performance of the vortex tube The 328-50H (series) Vortec tube consumes 50 SCFM of compressed air. At cold-fractions between 30% and 70%, 15-SCFM (0.30*50) to 35-SCFM (0.70*50) of cold air is produced.

At these fractions, temperature drops of 118F to 71F (from compressed air inlet temps) are achieved.

The cold produced by the Vortec tube is mixed with suit return air (in the ECU plenum), and redistributed throughout the Robosuit[®].

Cold fractions can be adjusted (via hand-operated globe valve) to set either a desired air-exchange rate (turns/min) or to set targeted temperature drops.

You will increase the efficiency of the ECU (and lower air consumption) by applying wrap-style insulation over the hoses.

Installing Vortec Muffler

Thread the 3/4" NPT threaded section of the muffler into the brass valve body



Contact Roboworld for troubleshooting guidance, or replacement component information:

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