RoboTester Troubleshooting Kit

Instruction Manual
804010 - Revision 0

Hypertherm®

The world leader in plasma cutting technology™

RoboTester

Instruction Manual
P/N 804010

Revision 0 - December 2001

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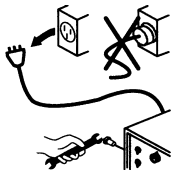
Section 1

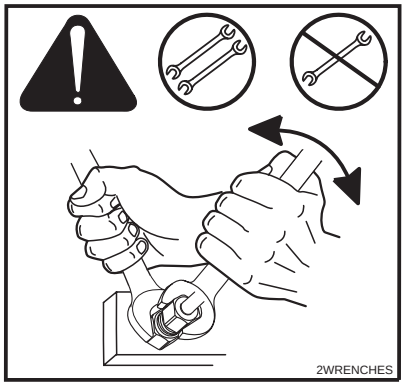
SAFETY

WARNING

ELECTRIC SHOCK CAN KILL



Turn off all electrical power before removing the power supply cover. Put the power supply circuit breaker in the OFF (0) position and set the line disconnect switch to OFF. In the U.S., use a "lock-out and tag-out" procedure until the service or maintenance is complete. In other countries, follow appropriate local or national safety procedures.



The RoboTester Troubleshooting Software is to be used only by qualified service personnel. It is an inherently “expert-only” system because it provides full manual control over the plasma system, so the technician can run all devices. This means you can create hazardous situations if you don’t know what you are doing!

Some simple rules can help prevent accidents:

– Always follow safety precautions in the instruction manual (803760) for the HD4070 system.

– Always disconnect power before touching any machine or device.

– Never let anybody near the system while you are troubleshooting it.

– Never leave a system unattended.

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Section 2

SOFTWARE INSTALLATION AND OVERVIEW

In this section:

Introduction

Note: The RoboTester software is only compatible with Windows ’95, ’98 and NT. The laptop computer being used must have a serial communication port.

> **Caution: Failure to use the Optical Isolator when connecting to the laptop can cause the communication port to be destroyed.**

The RoboTester is an effort to compensate for the trend toward more complex machines, by creating an automated troubleshooting tool. The HD4070 is the only product supported at this time, but the RoboTester is a testing framework that is flexible enough to accommodate other Hypertherm products. Current and future systems may be incorporated at a later date.

Core features:

– The ability to view and modify the internal state of all machines, down to individual devices. This gives the troubleshooter full manual control of the plasma cutting system.

– Automated tests. The troubleshooter can execute various testing scripts, see which areas are in good condition, which ones need attention and save the results to file.

– Troubleshooting database. As more information about each specific product is gathered over its lifetime, we can make the troubleshooting information increasingly specific, and the suggested remedies more accurate. The RoboTester is therefore a repository of troubleshooting experience.

Additional features:

– The "Demo mode" lets you learn how to use the RoboTester, without having to connect to real machines.

– Python is the Scripting language: Python is simpler than Visual Basic, and more powerful than Java. Experienced troubleshooters can create their own scripts.

– There is no installation program for the RoboTester, meaning it doesn't touch your Registry, and is very easy to upgrade. Also, the scripts and troubleshooting database are all contained in plain text files, which means no information is “locked” into a proprietary format.

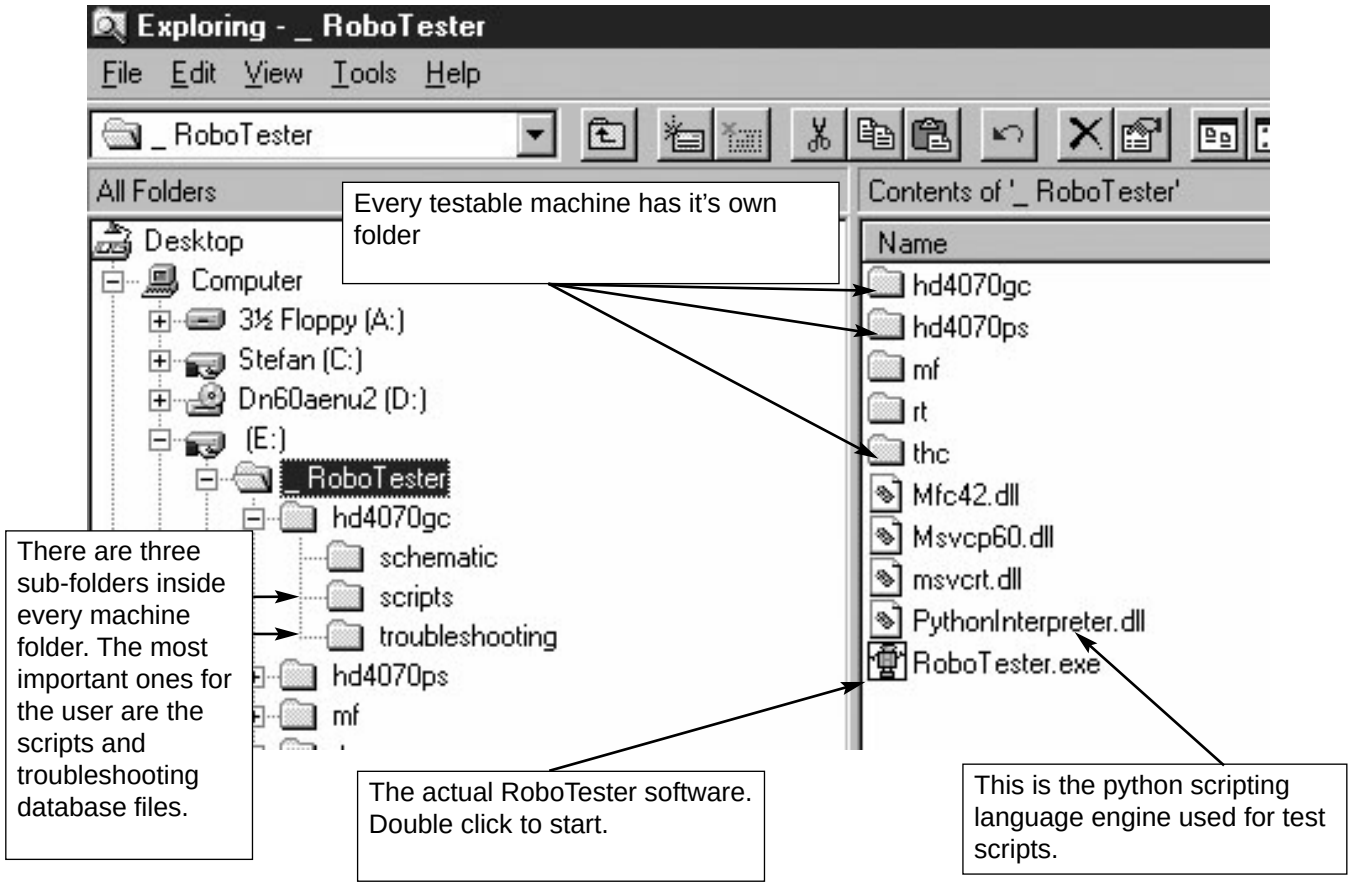
Software installation

Note: The RoboTester software is only compatible with Windows ’95, ’98 and NT.

– Obtain the latest copy of the RoboTester software diskette (available in the RoboTester toolbox). Insert disk into your laptop.

– The “RoboTester.zip” is just a WinZip file, so you can extract it to any location you want on your hard drive. This also means that uninstallation and upgrades are just a matter of deleting the RoboTester folder, and unzipping a newer version.

– After unzipping, you should see something like this in the Windows Explorer



RoboTester Overview

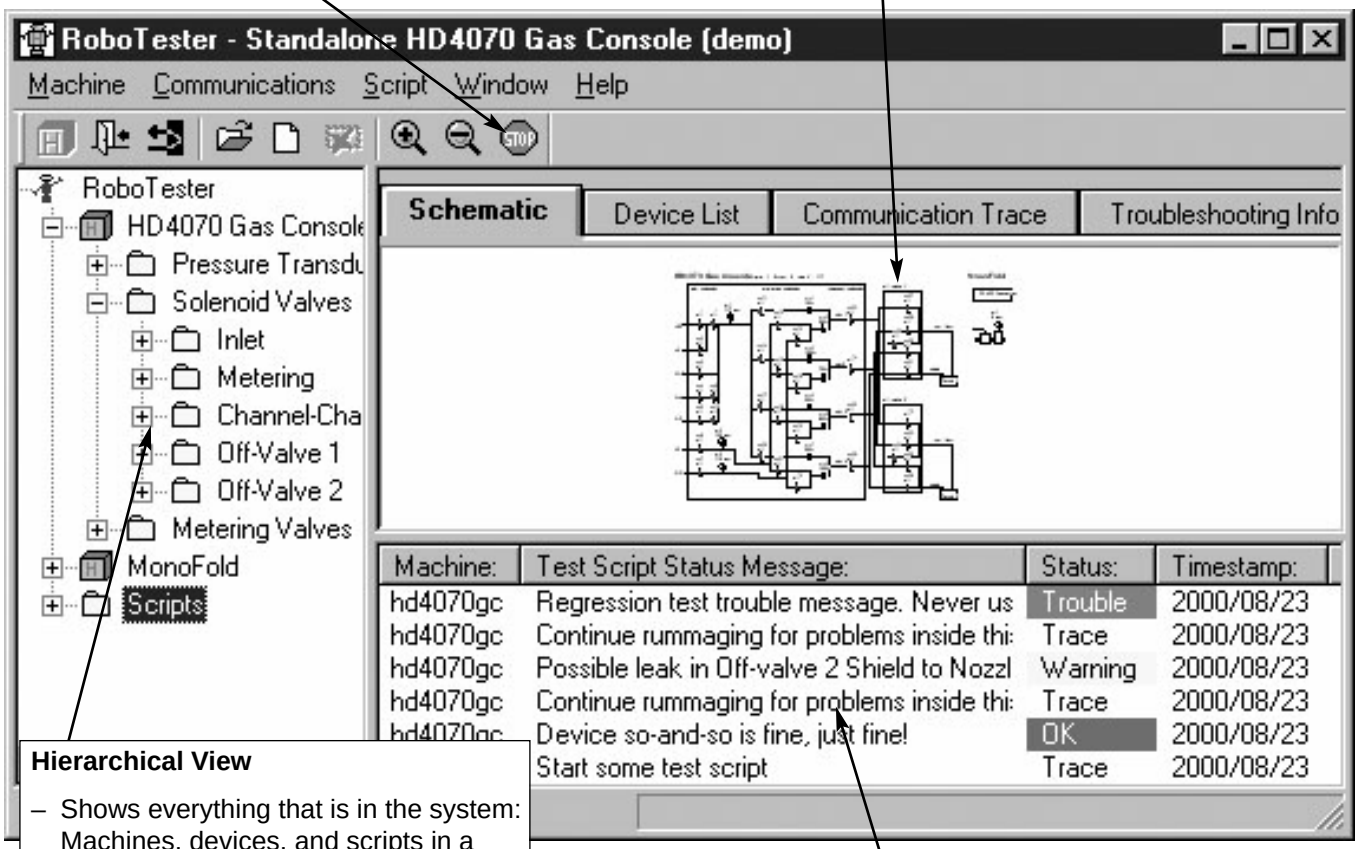
E-Stop button

– Puts all machines in a fail-safe mode

– The “break” key (on the laptop) has the same function

Schematic view

– Graphically displays the most important devices



Hierarchical View

– Shows everything that is in the system: Machines, devices, and scripts in a “whole part” view

Trouble message view

– Shows the results of test scripts

– Lets you display troubleshooting information, by right clicking on the trouble message

Manipulating machines and devices

In general, double-clicking or right-clicking any machine or device in the hierarchical view, the schematic view or the device list view will let you manipulate it.

Double-clicking usually causes some “default” behavior. For an “on-off” type of device, Double-clicking will toggle it between the on and off states.

Right click on machine in hierarchical view

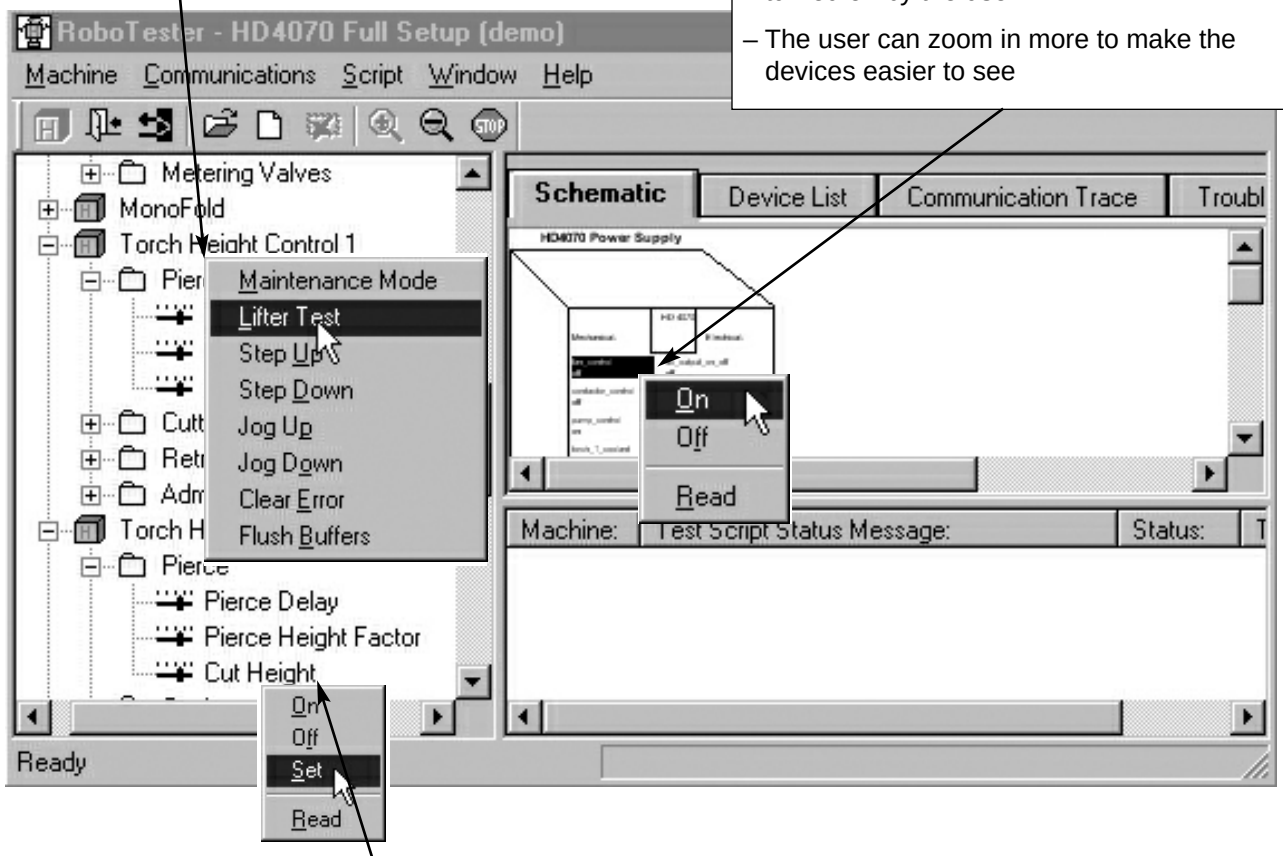
– This allows you to manipulate both machines and devices

– This can also be accomplished by right-clicking the machine name in the schematic view

Right-click on device in schematic view

– The fan for the power supply is shown being turned on by the user

– The user can zoom in more to make the devices easier to see



Right-click on device in hierarchical view

The user is setting the Cut Height. The same action can be taken from the “device list” view

Executing test scripts

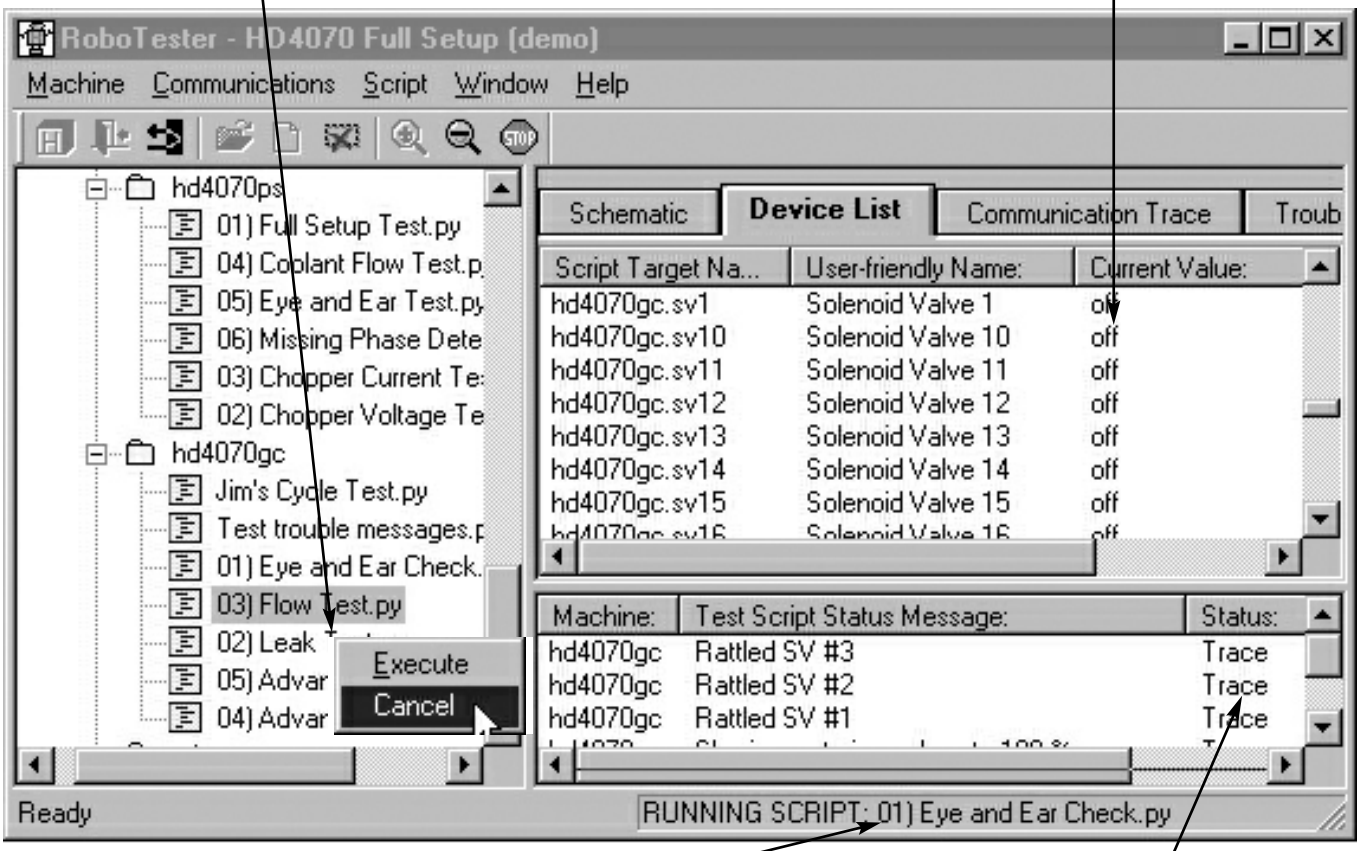
Starting and stopping a script

– Right-clicking will allow the user to turn a script on and off. The menus or toolbar buttons can also be used

– In the example shown: the user is stopping the script

Viewing status changes

– The “device list” and “schematic” views will show updated device and machine statuses



Knowing if a script is running

– When a script is running, the status bar at the bottom of the main window displays it’s name

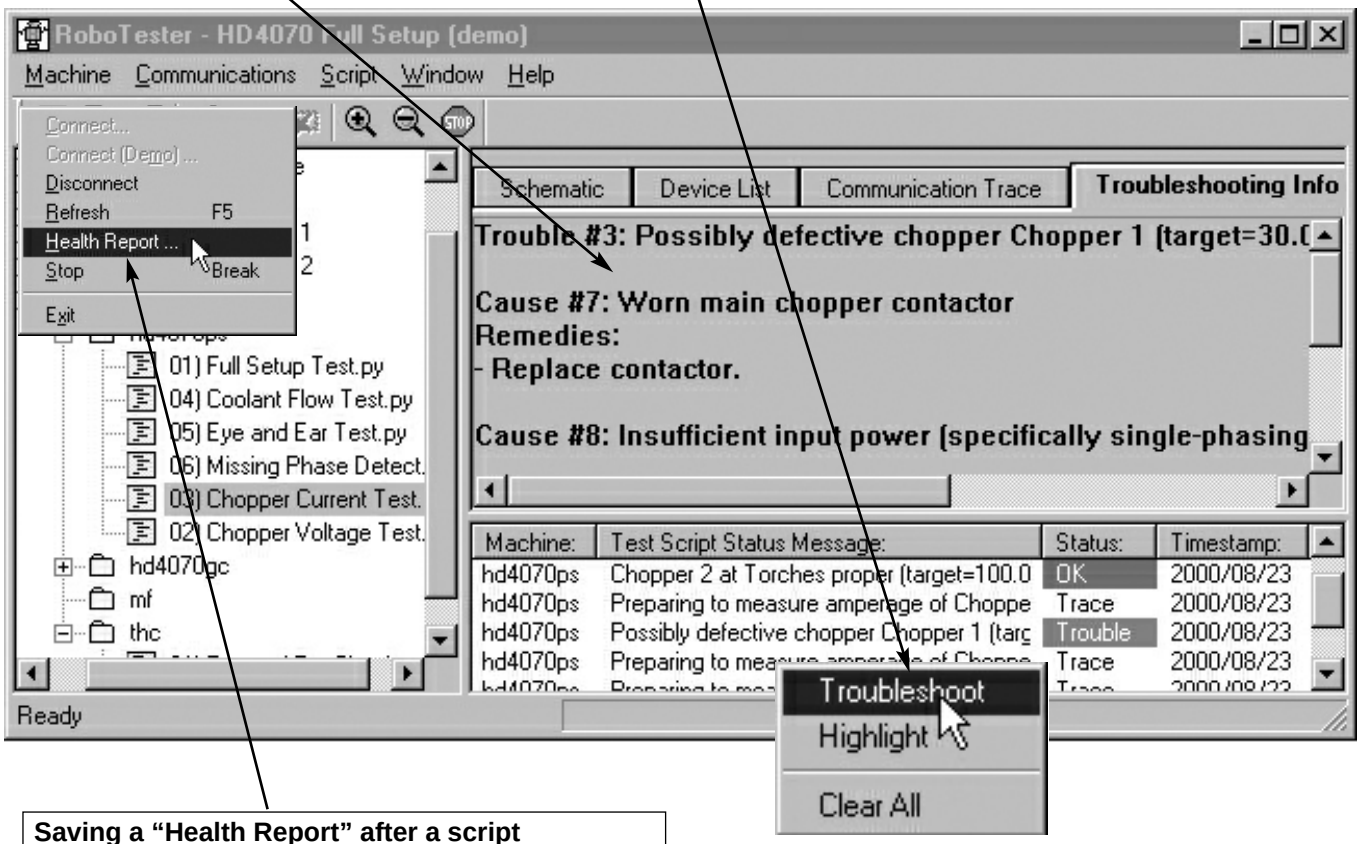
Understanding what the script is doing

– A well written script will regularly send trace messages to the “trouble message” view to let the user see what it is currently doing

Viewing script results

Showing troubleshooting information

– The user has right-clicked on a trouble message, and chosen “Troubleshoot”. The troubleshooting information is displayed in the “troubleshooting Info” view



Saving a “Health Report” after a script

– Choose “Health report” from the machine menu to save the results of a script to file

– The menu item is only available if there are red, yellow or green trouble messages available

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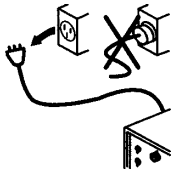
Section 3

SETUP AND OPERATION

In this section:

HD4070 – Figure list


WARNING
ELECTRIC SHOCK CAN KILL



Disconnect electrical power before performing any maintenance.
All work requiring removal of the power supply cover must be performed by a qualified technician.
See *Section 1* of the Operator Manual for more safety precautions.

Caution: Failure to use the Optical Isolator when connecting to the laptop can cause the communication port to be destroyed.

Note: The RoboTester software is only compatible with Windows ’95, ’98 and NT. The laptop computer being used must have a serial communication port.

System Set-Up: Full system or power supply only

Enables testing of the entire plasma system

Items needed: See parts list for details

#16 I/O Shunter Diskette
#25 Null Modem Dongle
#26 CNC Dongle
#29 Extension Cable
#29a optical Isolator

Set-Up

1 – Remove top and side panels from power supply.
2 – Connect the Optical Isolator to the communication port on the laptop computer.
3 – Connect Extension Cable to the Optical Isolator..
4 – Connect opposite end of Extension Cable to Null Modem Dongle.
5 – Connect Null Modem Dongle to J7 on Breakout board (PCB6).
6 – Install CNC Dongle,If no CNC cable is connected to power supply.
7 – Make sure all door switches (3) are satisfied.
8 – Insert the I/O Shunter Diskette into floppy disk drive.
9 – Turn power on HD4070 and wait until floppy disk is loaded into the HD4070 system.

System setup: Full system or power supply only

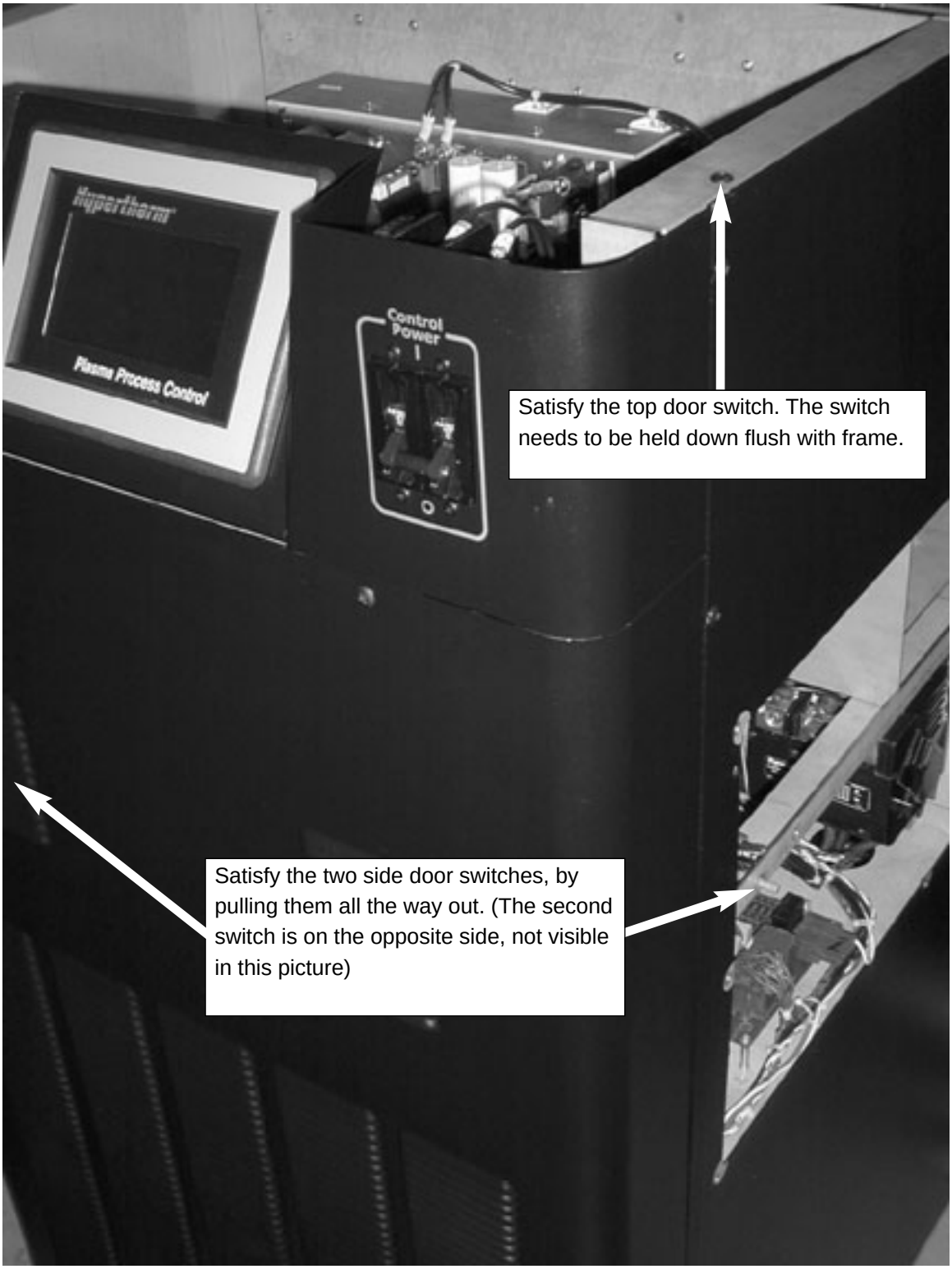


Figure 1 Satisfying interlock switches

System setup – continued

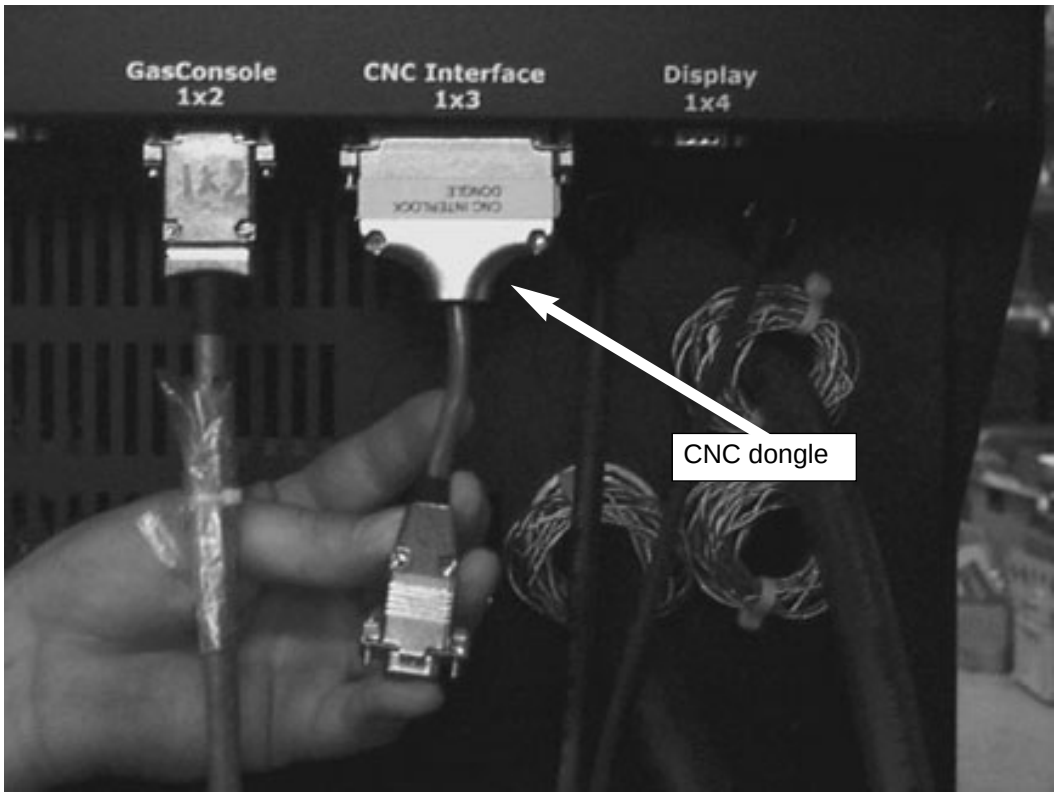


Figure 2 CNC dongle connection

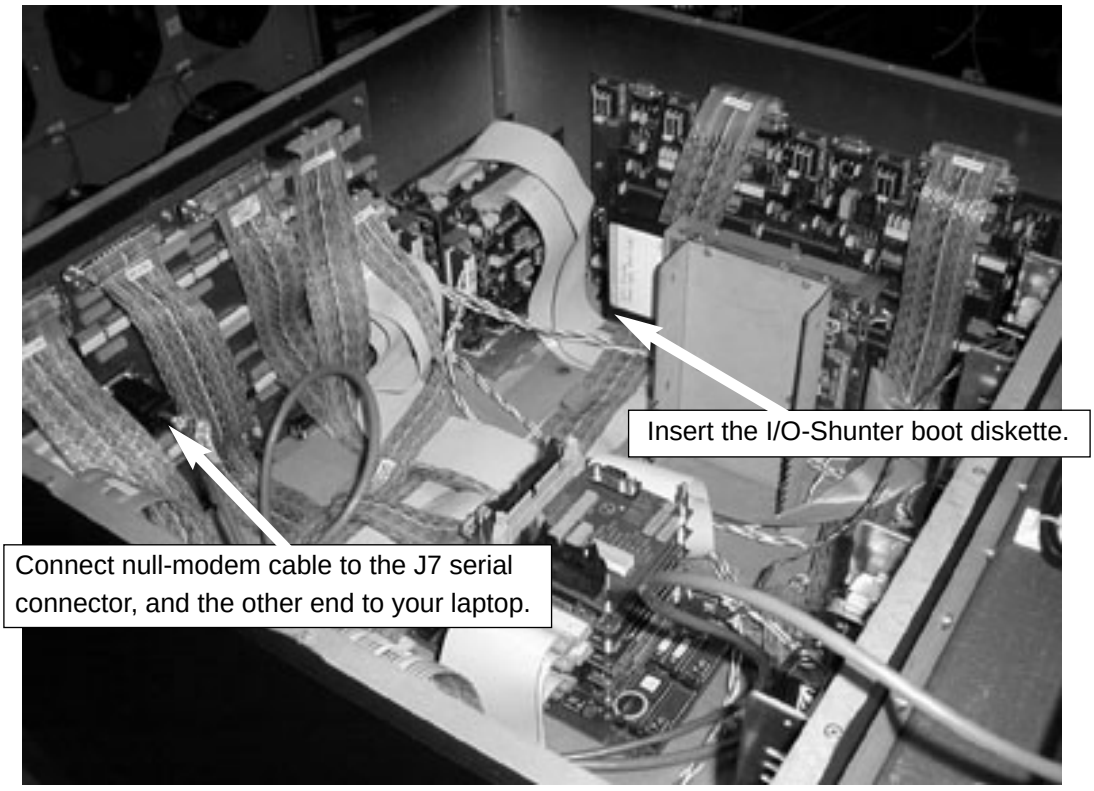


Figure 3 Null modem to J7 connection and disk drive location

System setup – continued

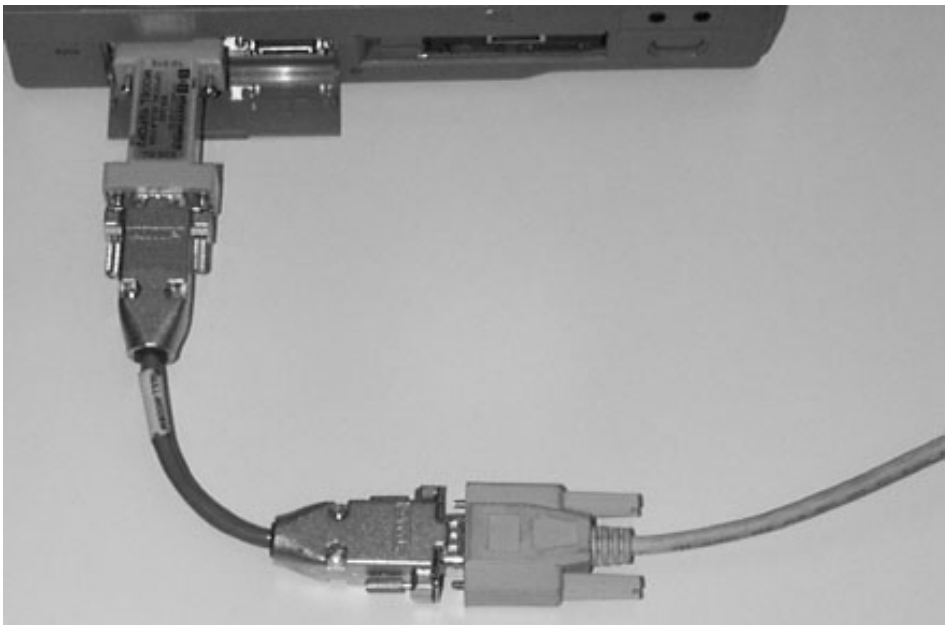


Figure 4 Connection of the laptop serial port to the null-modem dongle

Robotester startup

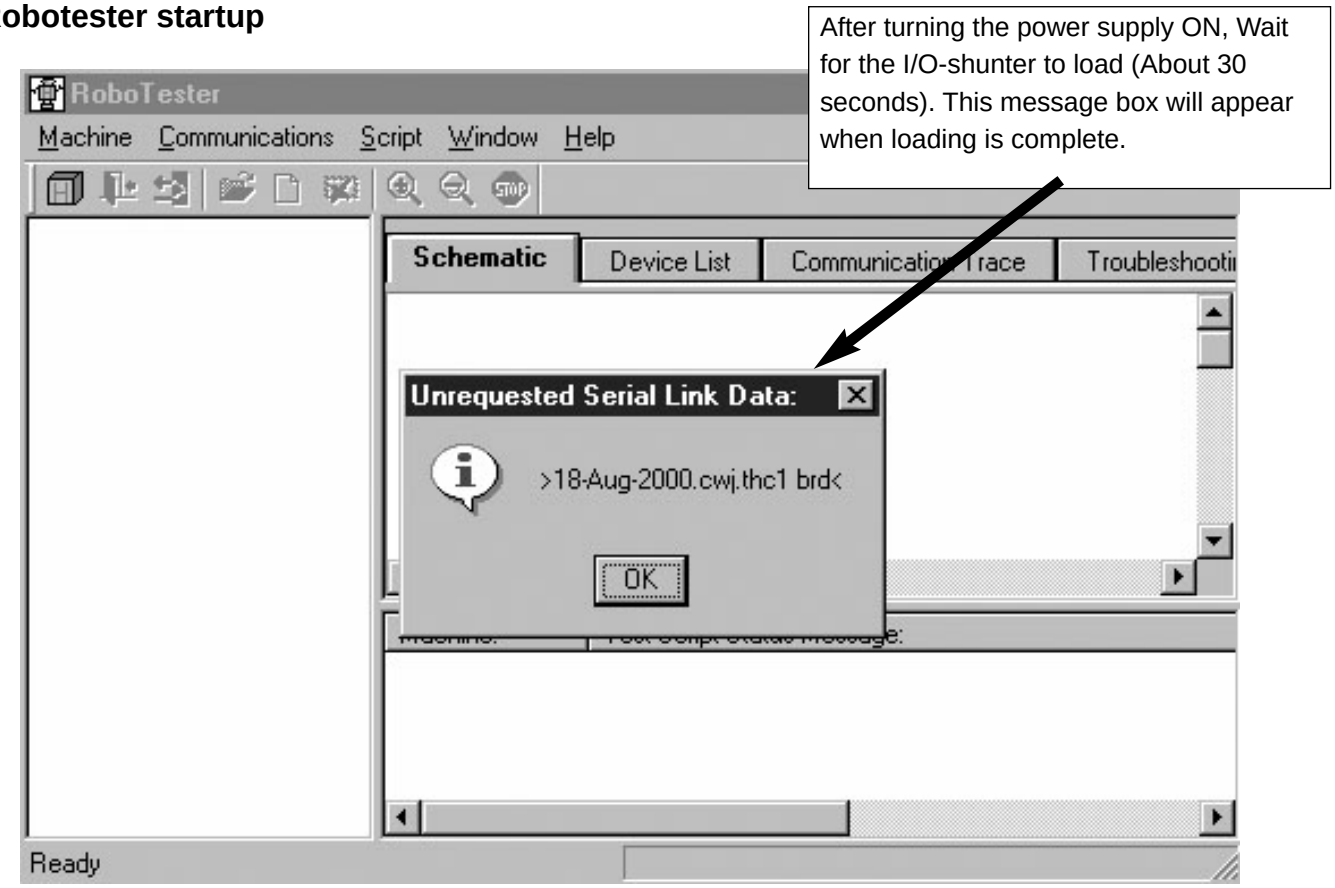


Figure 5 Robotester startup 1

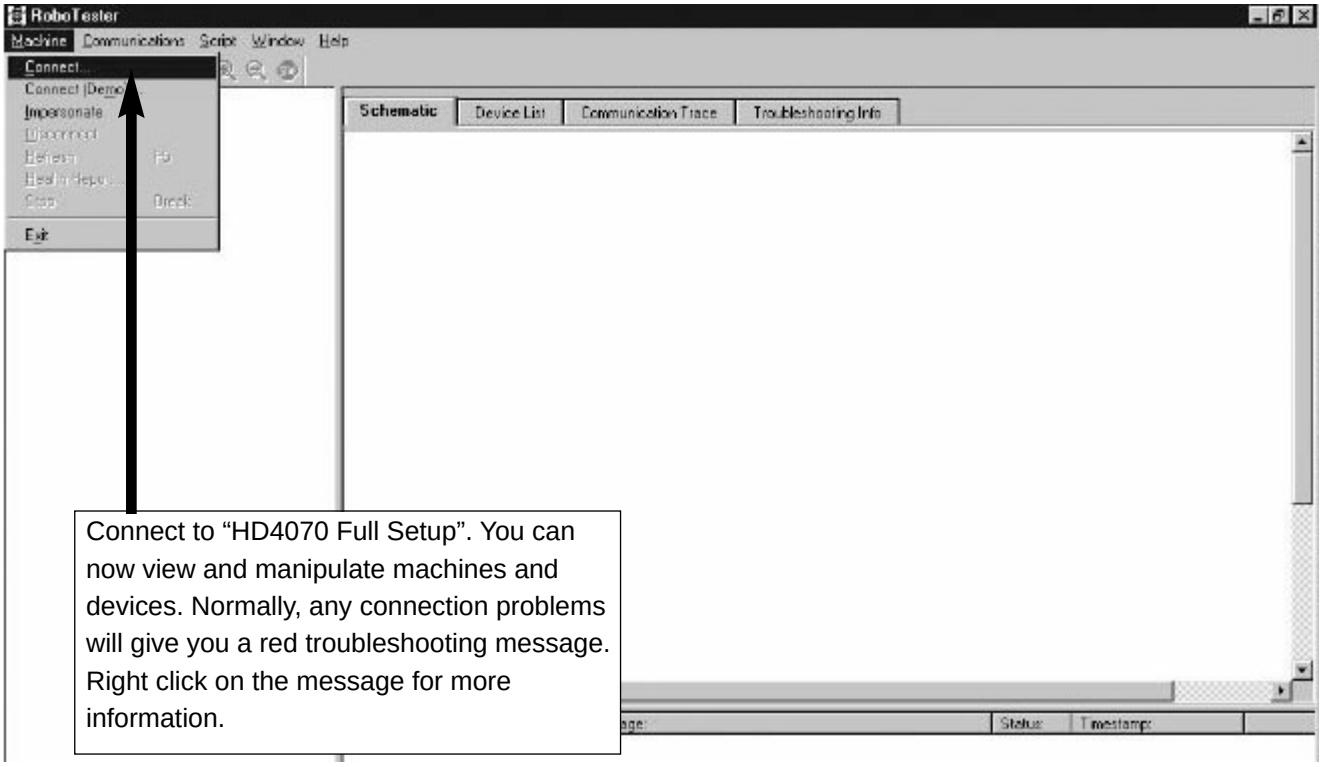


Figure 6 Robotester startup 2

Stand Alone Gas Console test

Enables testing of gas console as a stand alone unit.

Items needed: See parts list for details

#22 RS-422 Converter
#23 Gas Console Dongle
#29 Extension Cable (2)
#29a Optical Isolator
#30 Gas Console Power Cable

Set-Up

1 – Connect the Optical Isolator to the communication port on the laptop computer.
2 – Connect Extension Cable to the Optical Isolator.
3 – Connect opposite end of Extension Cable to the RS-232 port on the RS-422 Converter.
4 – Connect one end of the second Extension Cable to the RS-422 port on the RS-422 Converter.
5 – Connect opposite end of Extension Cable to Gas Console Dongle.
6 – Connect opposite end of Gas Console Dongle to 3X2 on back of Gas Console.
7 – Connect the Gas Console Power Cord to 3X1 on back of Gas Console.

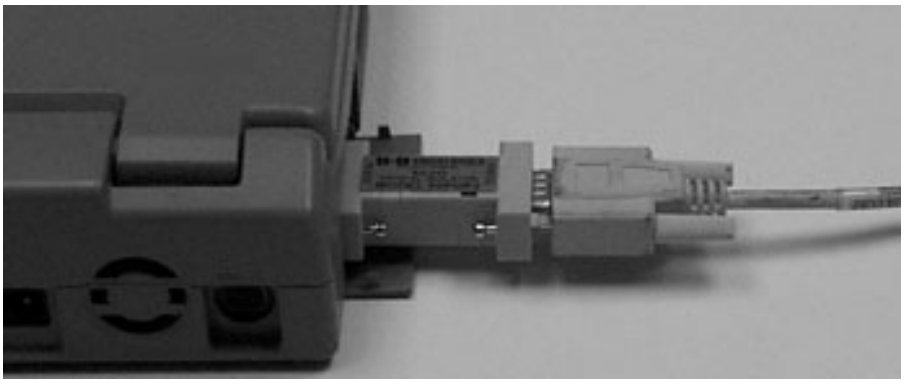


Figure 7 Connection of the laptop serial port to the RS-422 converter

Stand alone gas console test – continued

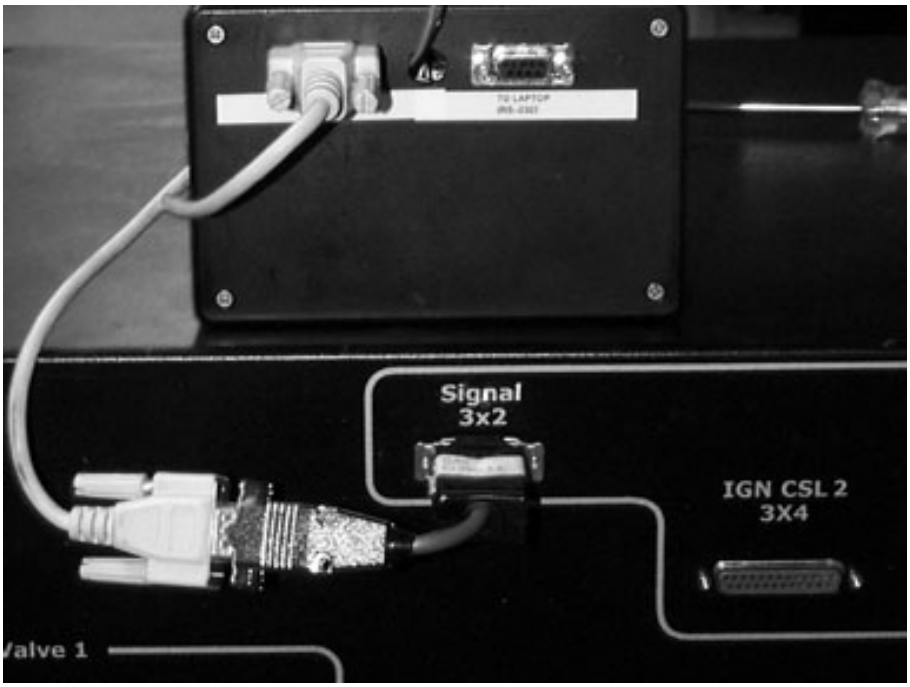


Figure 8 Connection of the RS-422 converter to the stand-alone gas console

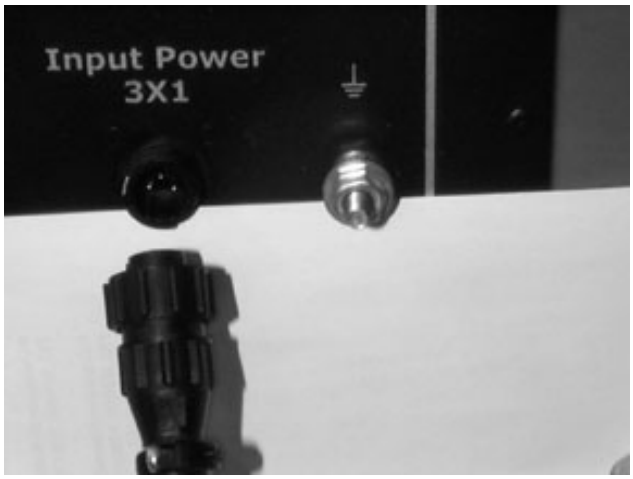


Figure 9 Connection of gas console power (VAC input)

Stand alone THC test

Enables testing of Command THC as a stand alone unit.

Items needed: See parts list for details

#22 RS-422 Gas Console Dongle
#24 THC Dongle
#29 Extension Cable (2)
#29a Optical Isolator

Set-Up

1 – Connect the Optical Isolator to the communication port on the laptop computer.
2 – Connect Extension Cable to the Optical Isolator.
3 – Connect the other end of the extension cable to the RS-232 port on the RS-422 converter.
4 – Connect one end of the second extension cable to the RS-422 port on the RS-422 converter.
5 – Connect the other end of the second extension Cable to the THC Dongle.
6 – Connect THC Dongle to J4 on the THC Control board you want to test.

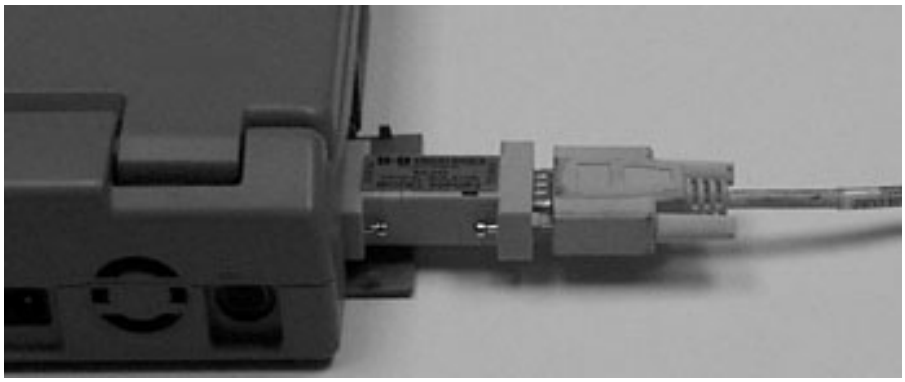


Figure 10 Connection of the laptop serial port to the RS-422 converter

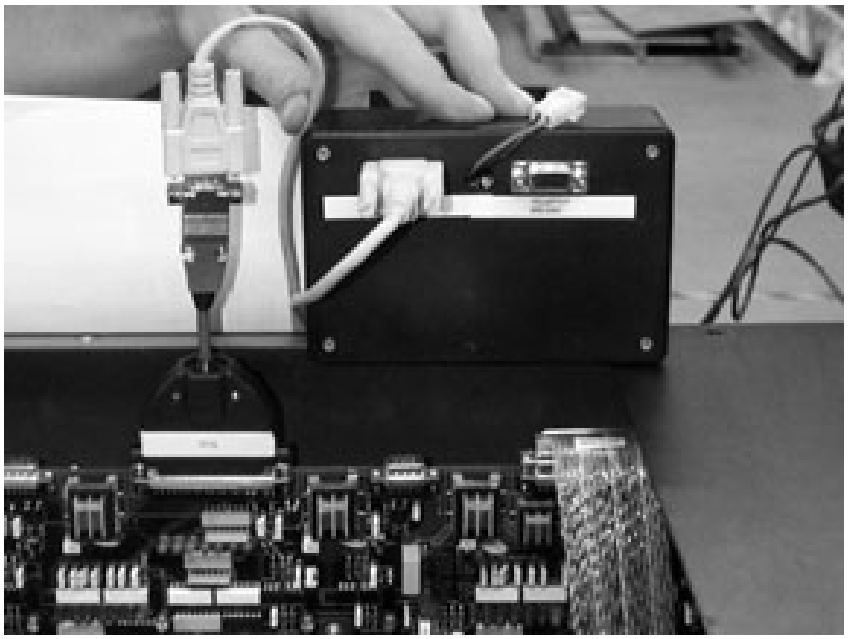


Figure 11 Connection of the RS-422 converter to the stand-alone THC connector (J4)

Gas flow test

Checks the gas flow from the Gas Console through the torch. Will isolate flow errors in the torch leads, consumables, gas leads, and/or gas console.

Items Needed: See parts list for details

#3 Inert to Right Hand 'A' Adapter (N^2)
#8 Small Orifice Assembly
#9 Large Orifice Assembly
#10 100A Mild Steel Nozzle/Shield Assembly
#11 100A Swirl-ring Assembly
#11a 100A Electrode
#17 Inlet Manifold Assembly
#18 Slip-on Torch Cap Assembly
#19 Regulator Assembly
#21 Pressure Transducer Manifold Assembly
#32 Right Hand 'A' Hose Assembly (2)

Set-Up

1 – Install Inlet manifold assembly to Inlet manifold of gas console.
2 – Connect input hose of the inlet manifold to the outlet side of the regulator assembly.
3 – Connect one of the hose assemblies to the inlet side of the regulator assembly.
4 – Connect the other end of the hose assembly to the Inert Adapter.
5 – Connect the nitrogen supply line into the inert adapter.
6 – Install the 100A consumable parts into the torch.
7 – Install the slip-on torch cap assembly to the end of the torch. Make sure thumb screws tighten into the groove on the retaining cap.
8 – Connect hose end of the torch cap assembly to the pressure transducer manifold assembly. Make sure the shut-off lever is in the ON position.
9 – Connect the second hose assembly to the pressure transducer manifold.
10 – Connect opposite end of the Hose Assembly to the large orifice assembly.
11 – Connect Pressure Transducer Manifold Assembly cable to J2 on the gas console board (PCB2).
12 – Set pressure at regulator assembly to 100 psi (6.9 bar). Set gas pressure at source (N_2) to 120 psi (7.3 bar).

Before running the gas flow test, check the calibration of the 4 pressure transducers.

To check the calibration perform the following functions:
1 – Turn the gas shut-off lever on the pressure transducer manifold to the OFF position.
2 – Manually turn SV5, SV10, SV11, SV12, SV13, and SV23 ON.
3 – Read the pressure for PT1, PT2, PT3 and PT4.
4 – Values should be within +/- 2psi of each other.
If values are not within specification, call Hypertherm technical service for PCB2 calibration procedure.

Gas flow test – continued

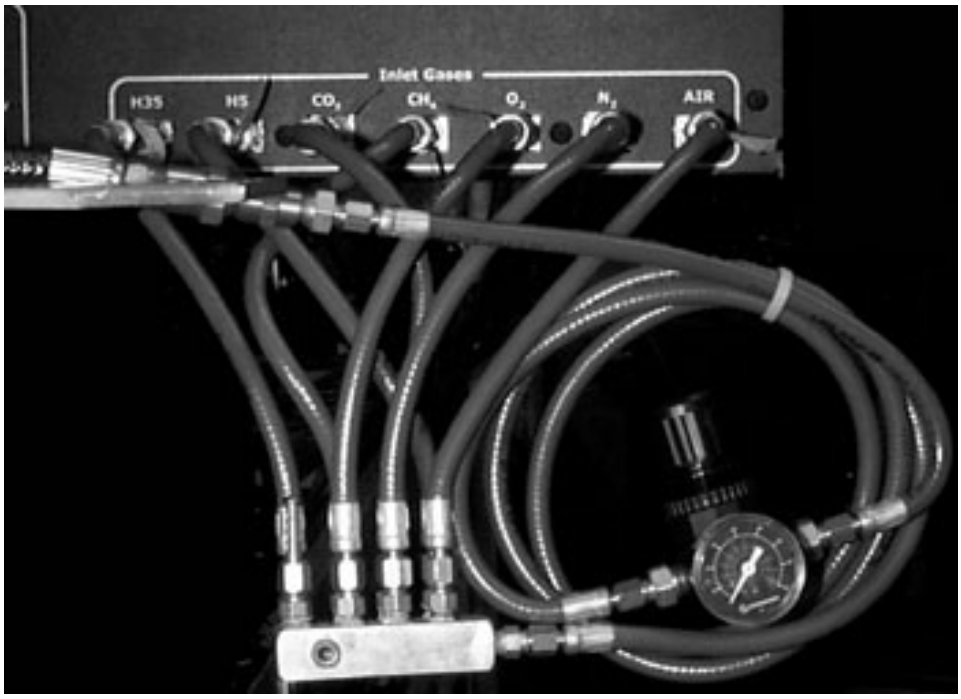


Figure 12 Gas console inlet manifold connection with regulator

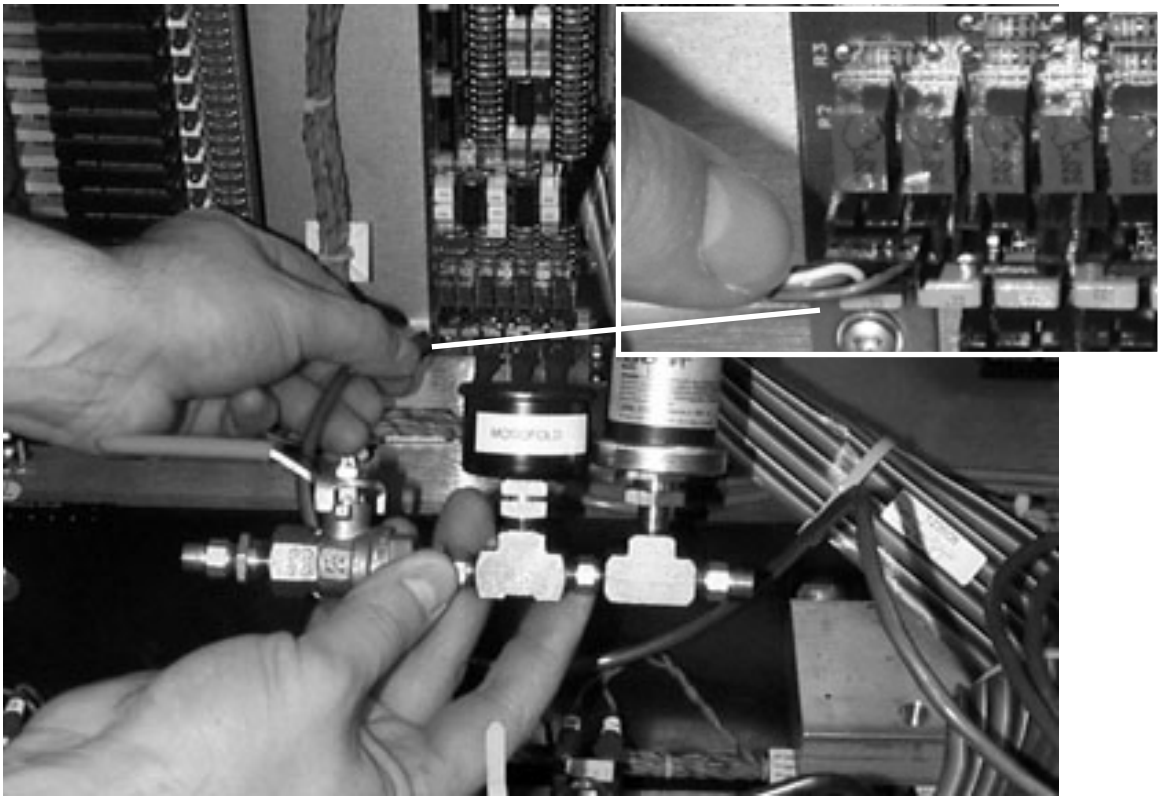


Figure 13 Gas console spare I/O port for pressure transducer manifold assembly

Gas flow test – continued

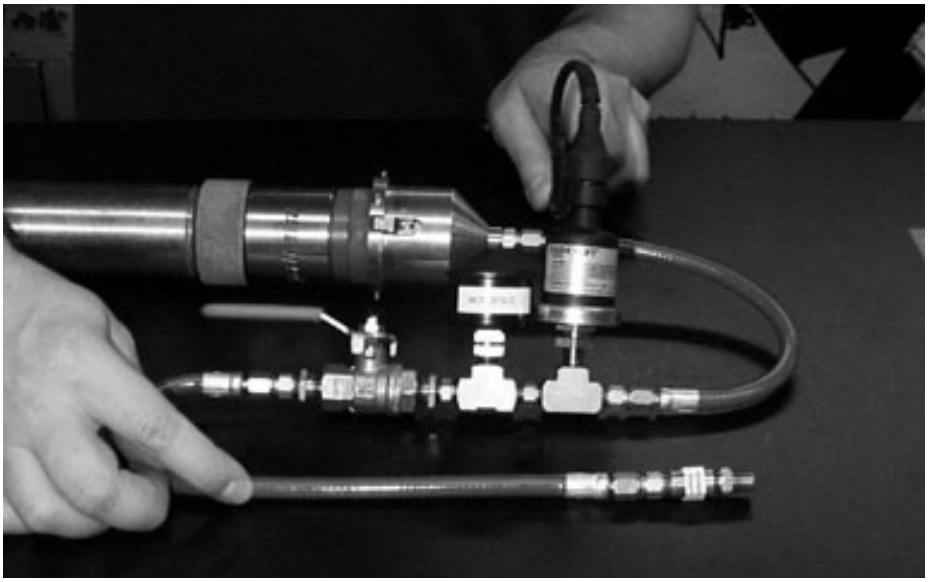


Figure 14 Torch slip-on cap, pressure transducer manifold and calibrated orifice

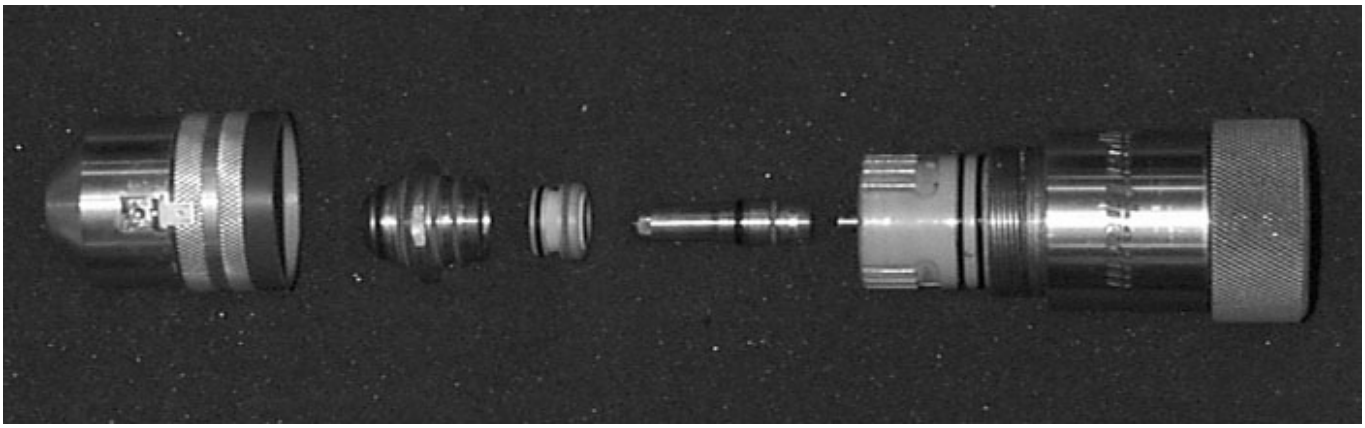


Figure 15 Torch and consumables reference for flow test

Gas flow test – continued

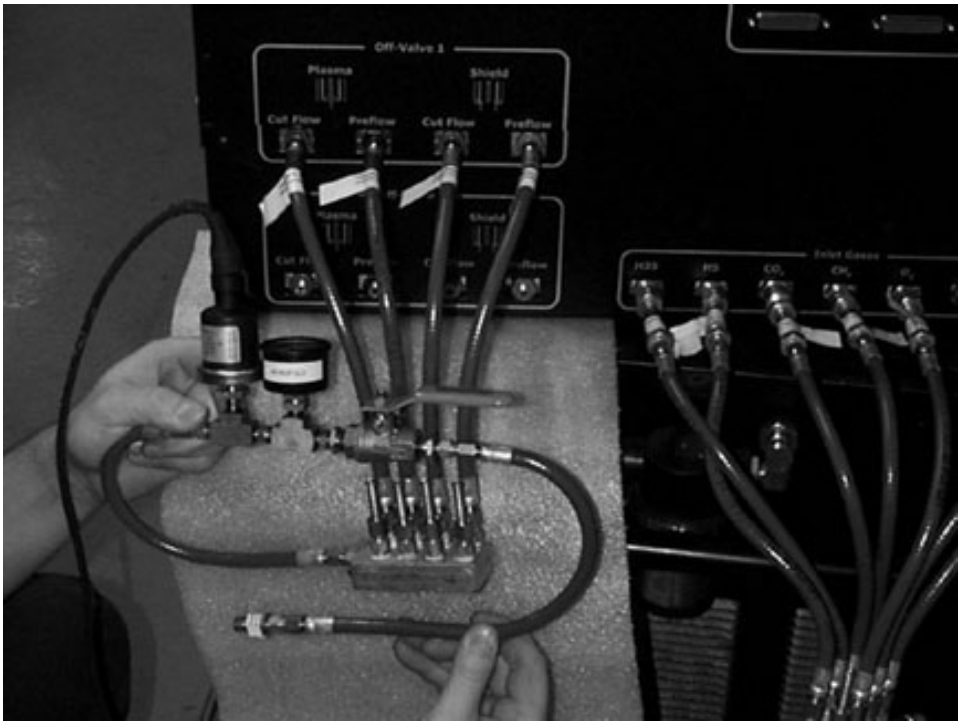


Figure 16 Gas console with outlet manifold, pressure transducer manifold assembly, and calibrated orifice

Chopper current test

Checks the current output of each chopper. Chopper 1 is tested a 30-amps and Chopper 2 is tested at 100-amps. If proper current is detected the choppers are functioning properly.

Items Needed: See parts list for details

#1 4/O Jumper Cable

Set-Up

1 – Remove Negative and Work Lead 4/O cables from large brass bus bars inside HD4070
2 – Install 4/O Jumper Cable across buss bars in place of Negative and Work Leads

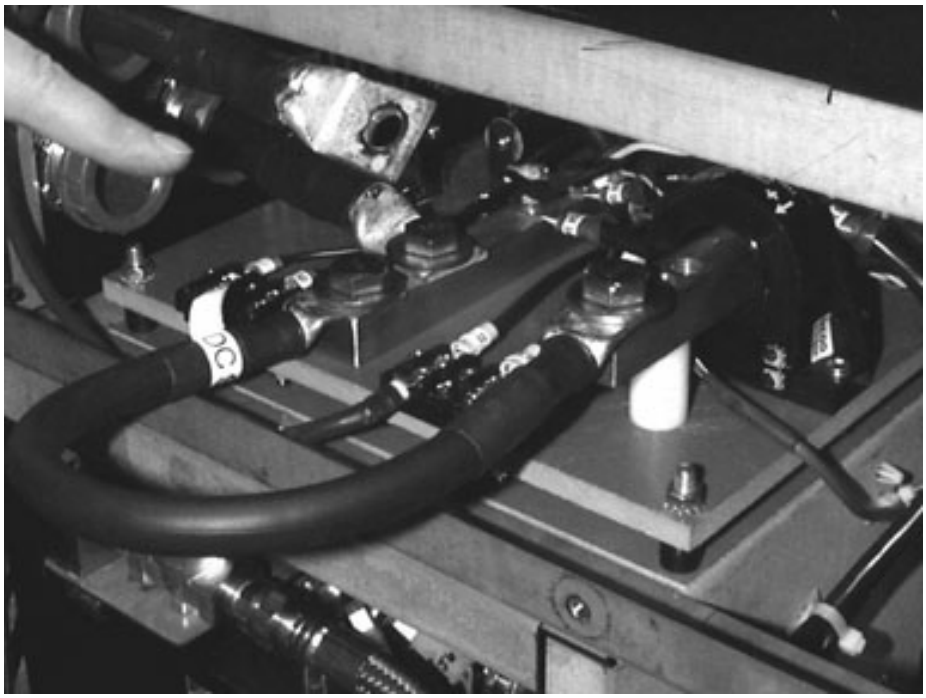


Figure 17 I/O Board shorted out with DC short wire

Chopper voltage test

Checks the open circuit voltage at various points in the plasma system.

Items Needed:

Digital Volt Meter – Not included in kit

Figure 18 output (wires 39 and 48) with digital volt meter (DVM)

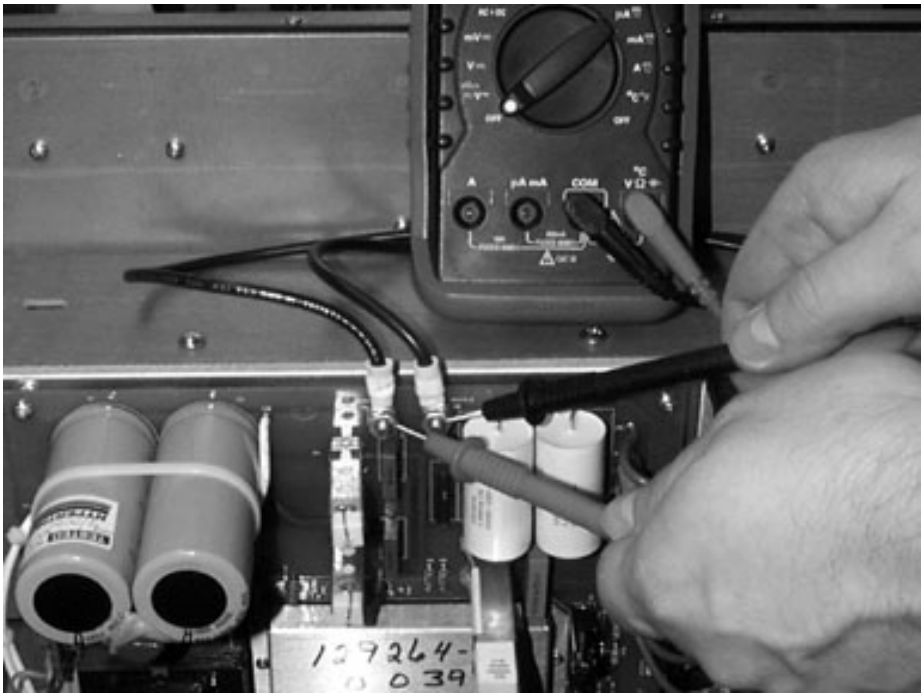


Figure 19 Pilot arc controller leads with DVM

Chopper voltage test – continued

Figure 20 I/O Board with DVM

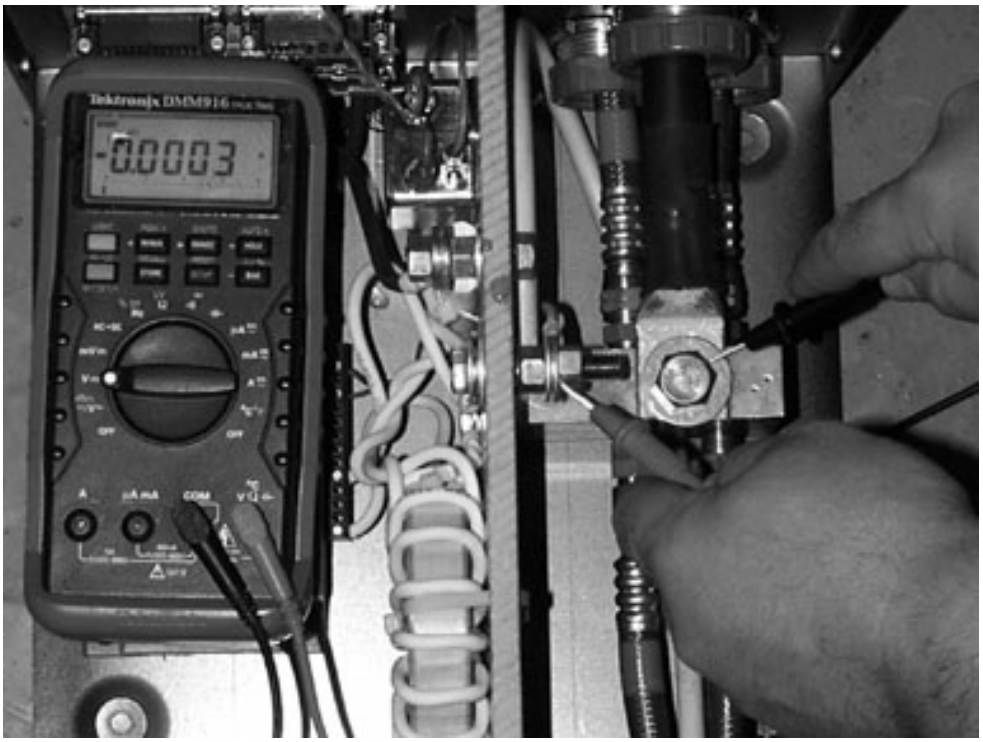


Figure 21 Torch leads (RHF box) with DVM

Chopper voltage test – continued

Figure 22 Torch head (electrode) with DVM

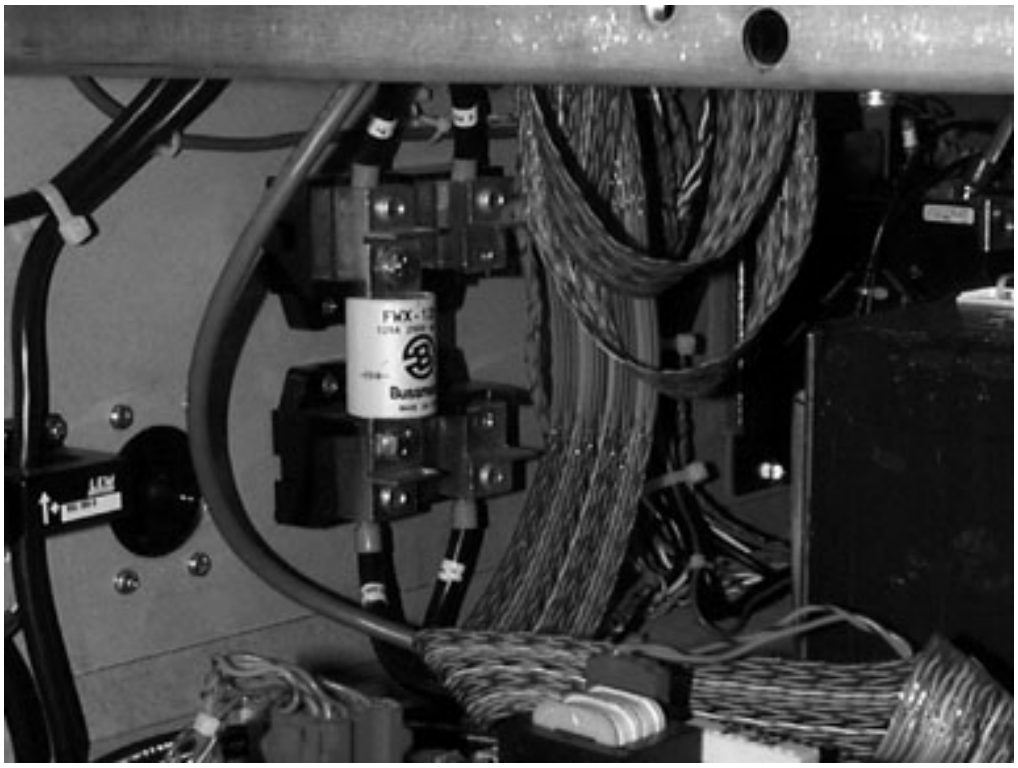


Figure 23 Power supply with chopper fuse 1 removed

Chopper voltage test – continued

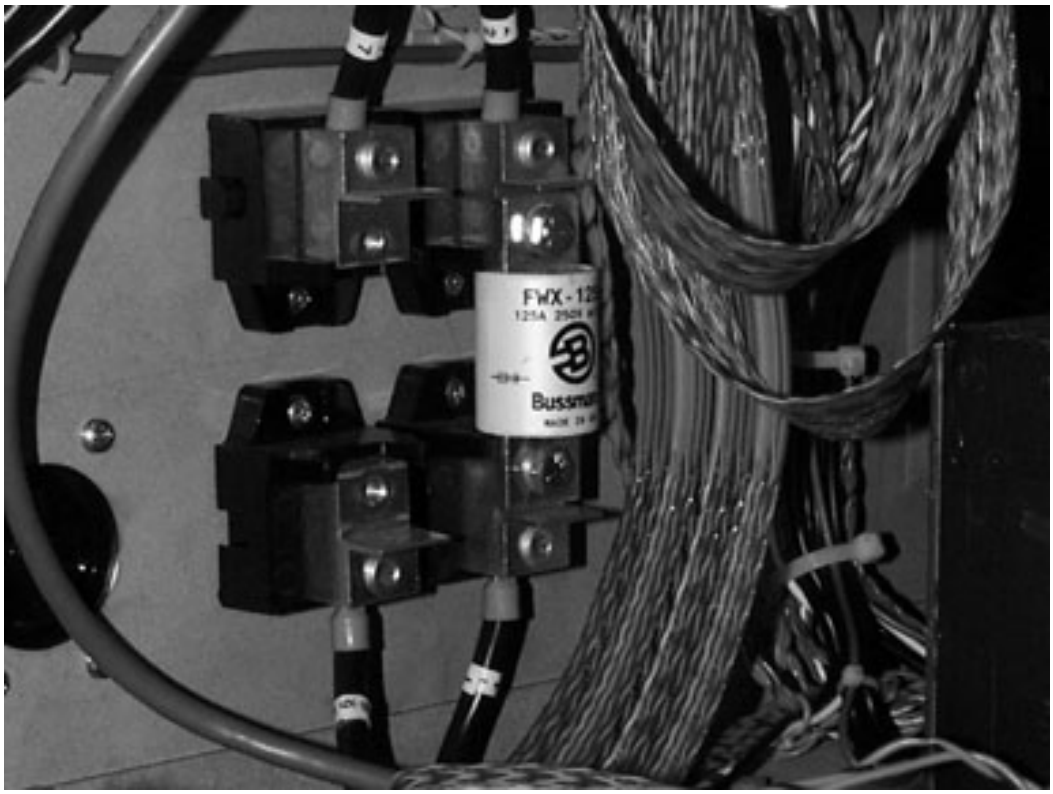


Figure 24 Power supply with chopper fuse 2 removed

Coolant flow test

Tests total coolant flow through each torch.

Items Needed:

1 Gallon Container – Not included in kit

Figure 25 Coolant return hose disconnected and placed in container for coolant flow test

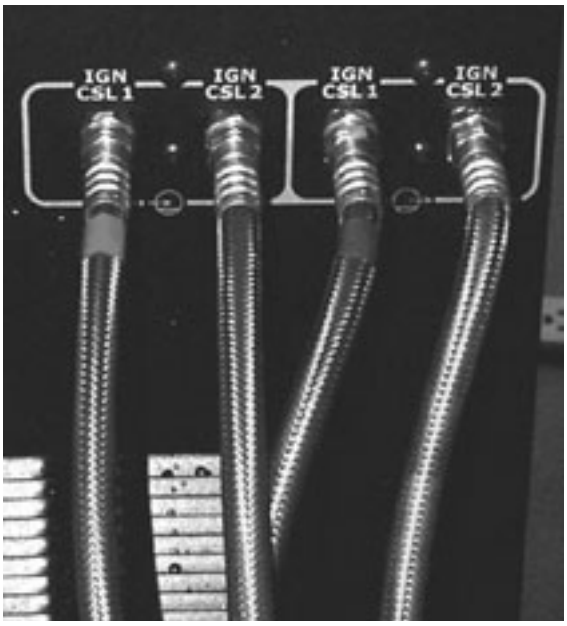


Figure 26 Connection of normal torch coolant hoses

Flow switch test

Tests the flow-switch by bypassing the torch and .

Items Needed: See parts list for details

#33 Coolant loop-back hose

Set-Up

1 – Install coolant loop-back hose in place of the torch coolant hoses for the torch that is being tested.

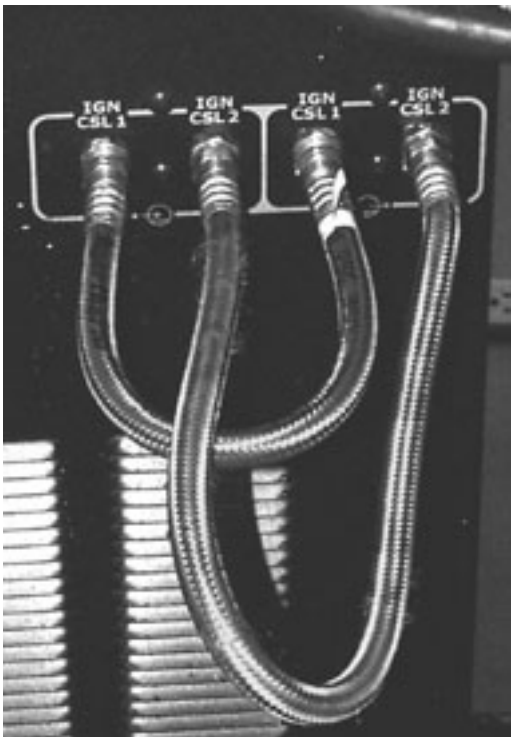


Figure 27 Connection of torch coolant loop-back hoses

Missing phase detect test

Tests the three phases on the secondary side of the main transformer.

Items Needed:

None

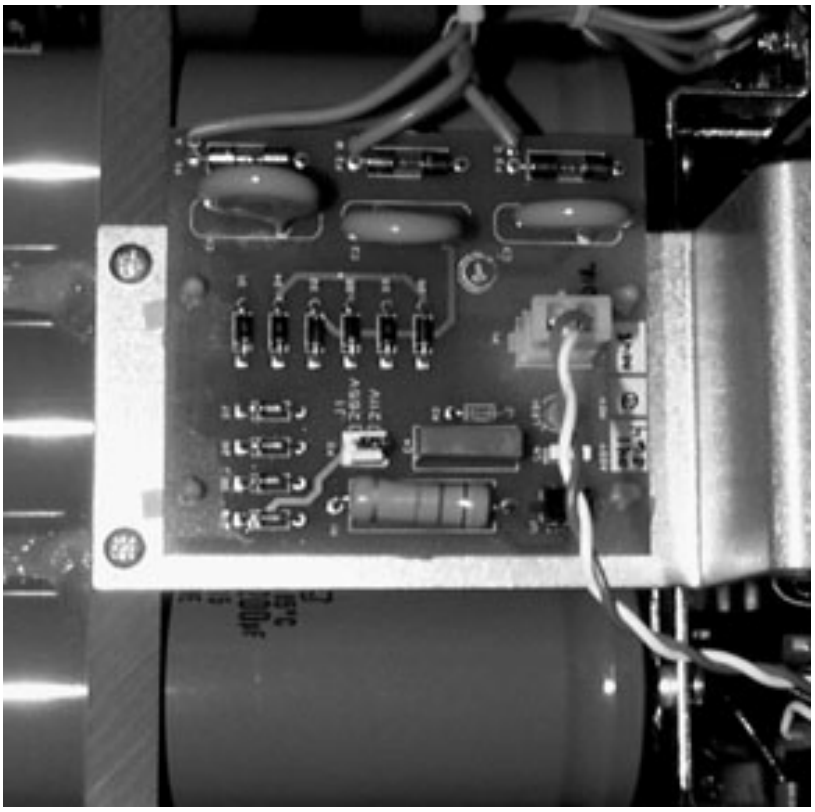


Figure 28 Phase loss detection board

Gas leak test

Checks for leaks from the torch to the gas console. Test is designed to locate leaks inside the gas console, or at the torch.

Items Needed: See parts list for details

#3 Inert to right hand ‘A’ adapter (N^2)
#12 Right hand ‘A’ plug (2)
#13 Left hand ‘A’ plug (2)
#14 Torch receptacle plug
#17 Inlet manifold assembly
#19 Regulator assembly
#32 Right hand ‘A’ hose assembly

Set-Up

1 – Remove all gas supply lines from the back of the gas console.
2 – Install inlet manifold to the gas console.
3 – Install outlet of regulator assembly to inlet manifold assembly.
4 – Install one end of the hose assembly to inlet side of the pressure regulator assembly.
5 – Install the other end of the hose to the inert adapter (N_2).
6 – Connect the N_2 supply line to the inert adapter.
7 – Set pressure at regulator assembly to 100 psi (6.9 bar). Set gas pressure at source (N_2) to 120 psi (7.3 bar).

Gas leak test – continued

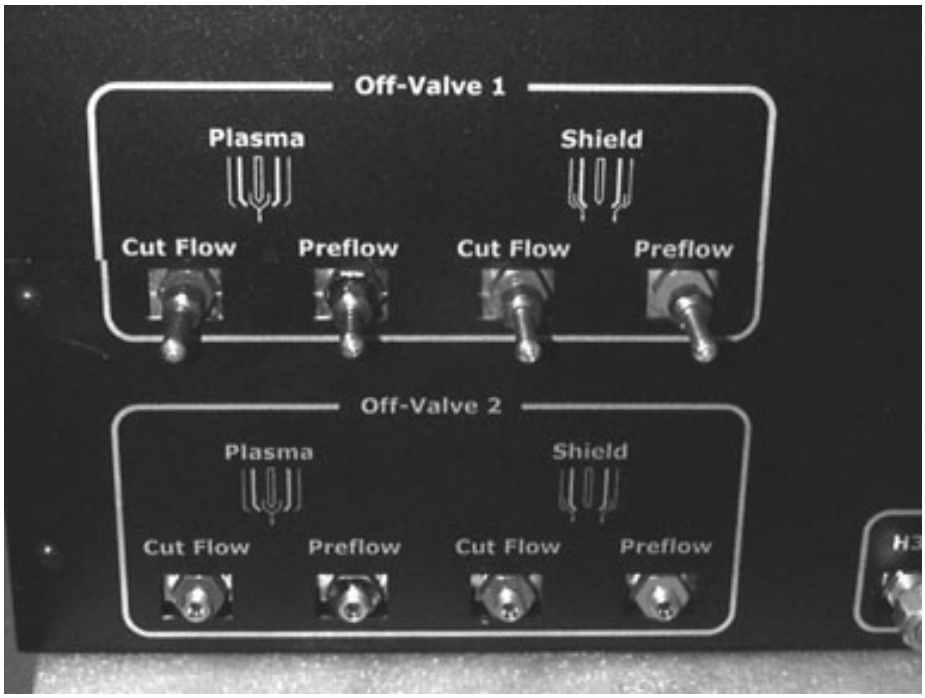


Figure 29 Gas console outlets for torch 1 plugged and torch 2 open

Figure 30 Torch and torch plug for leak test

Hypertherm

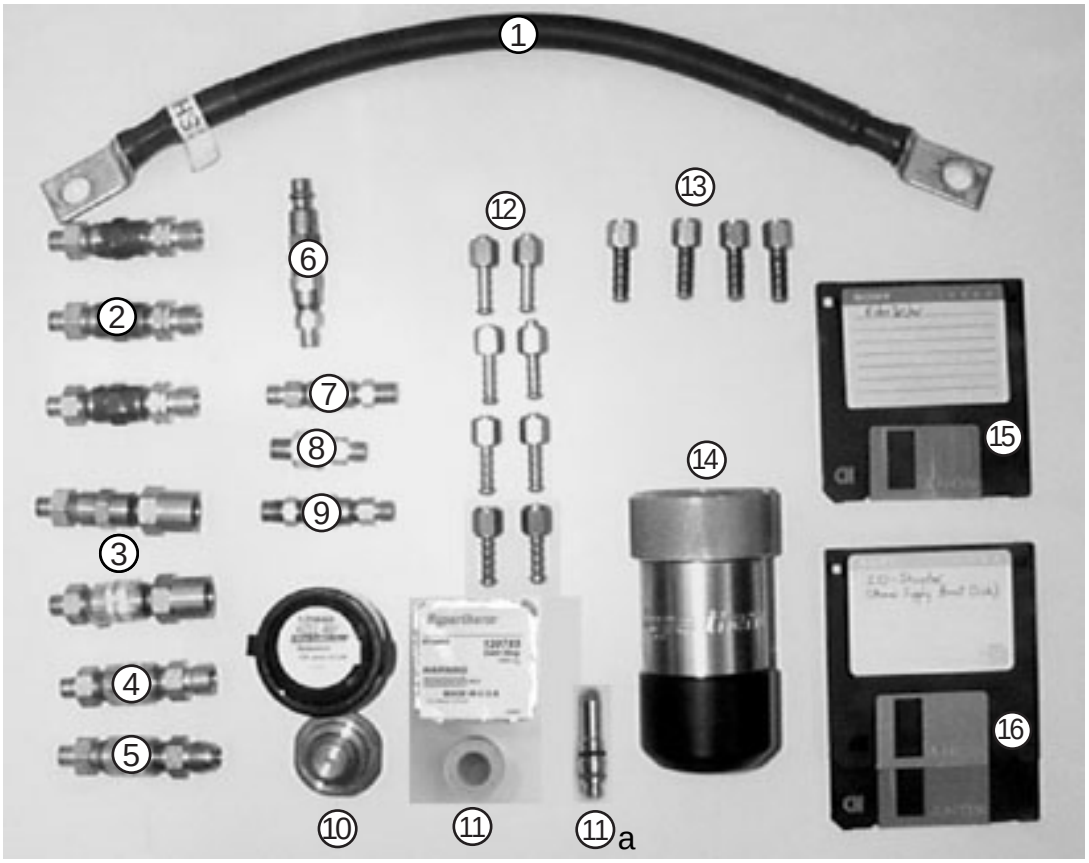
Section 4

PARTS LIST

In this section:

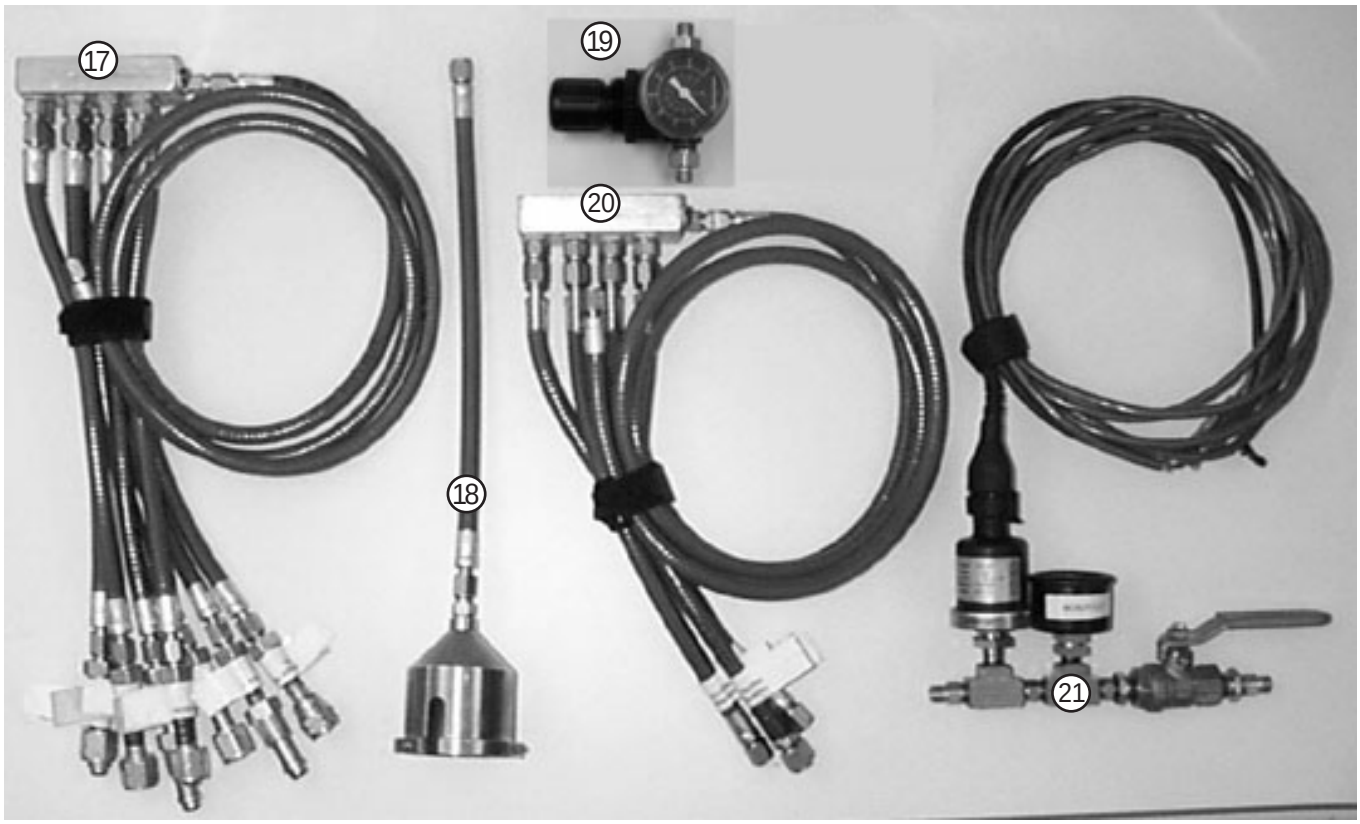
Parts list – Items 1-16

This list of hardware is not final, but gives a good idea of what the kit should contain



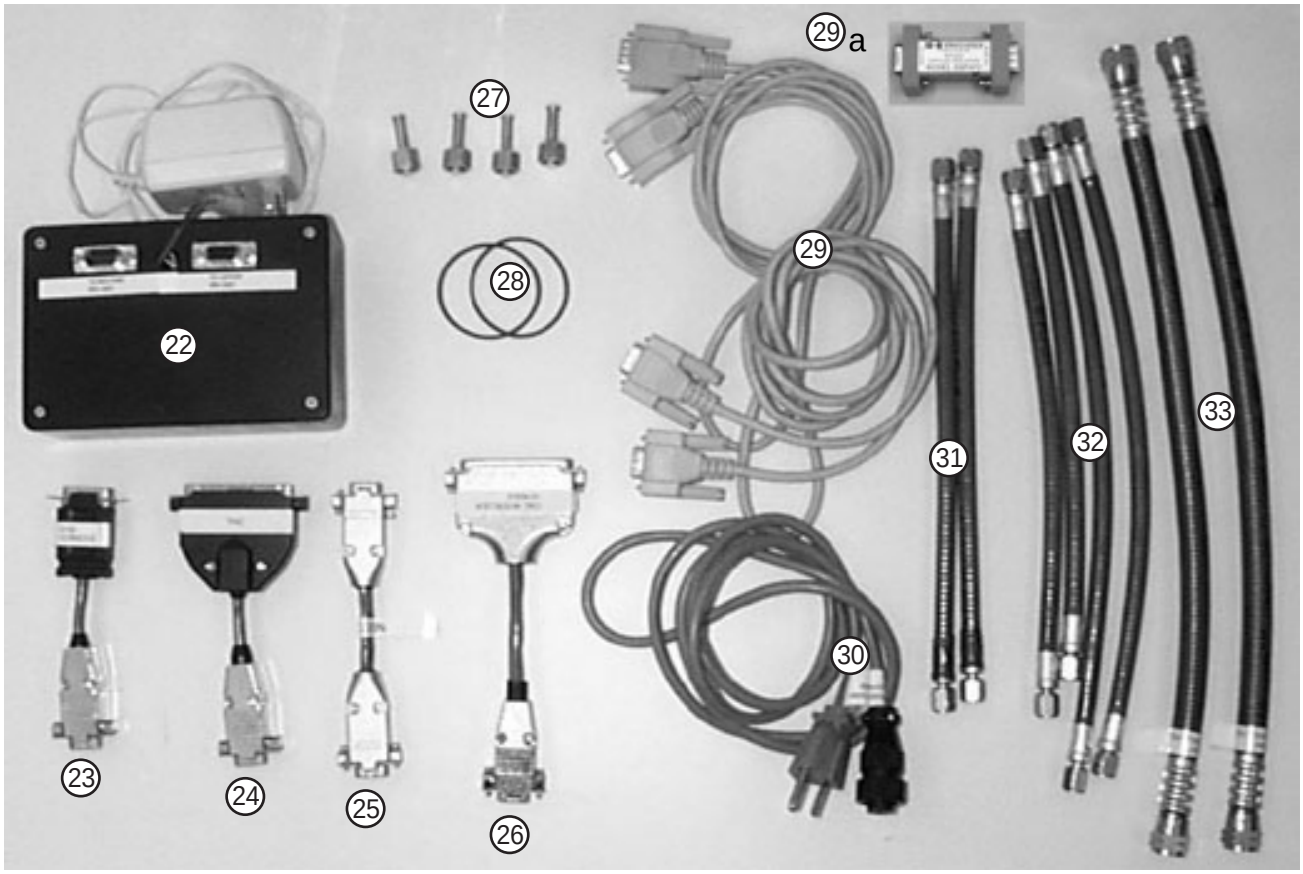
Item	Part Number	Description	Qty
1	123624	Cable to short circuit I/O board	1
2	128584	Adapter: Left hand ‘B’ to right hand ‘A’	3
3	128585	Adapter: Inert to right hand ’A’	2
4	128587	Adapter: Right hand ‘B’ to right hand ‘A’	1
5	128586	Adapter: #6 to right hand ‘A’	1
6	128593	Adapter: Right hand ‘A’ to quick disconnect	1
7	128590	Medium (.024") orifice assembly	1
8	128591	Small (.014") orifice assembly	1
9	128592	Large (.030”) orifice assembly	1
10	120660	100A mild steel nozzle/shield assembly	1
11	120783	100A Swirl ring	1
11a	120654	100A Electrode	1
12	004918	Right hand ‘A’ plug	8
13	004917	Left hand ‘A’ plug	4
14	129671	Torch receptacle plug	1
15	081069	RoboTester software	1
16	081070	I/O shunter diskette (2 copies provided)	2

Parts list – Items 17-21



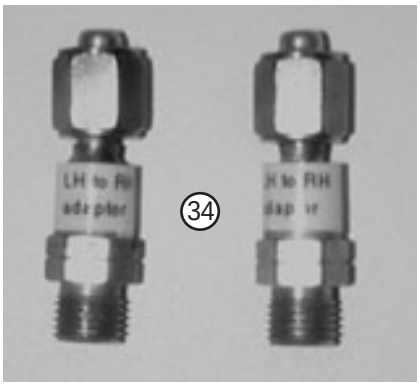
Item	Part Number	Description	Qty
17	128597	Inlet manifold assembly	1
18	128581	Slip-on torch cap assembly	1
19	128594	Regulator assembly	1
20	128617	Outlet manifold assembly	1
21	128582	Pressure transducer manifold assembly	1

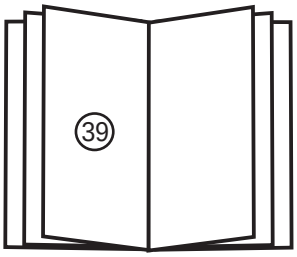
Parts list – Items 22-33

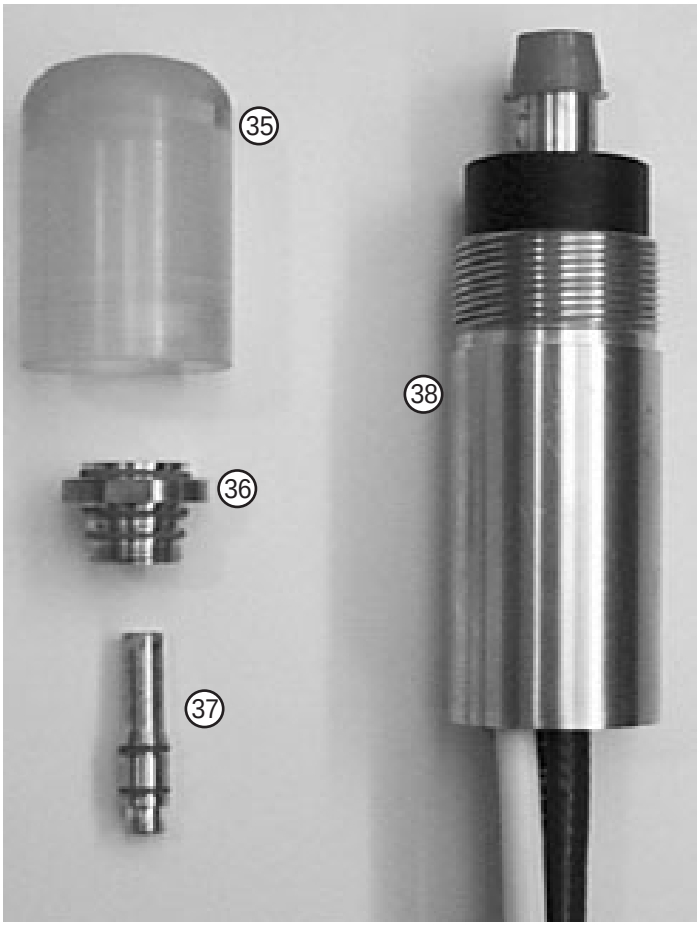


Item	Part Number	Description	Qty
22	128614	RS-422 converter	1
23	123626	Gas console dongle	1
24	123625	THC dongle	1
25	123628	Null modem dongle	1
26	123629	CNC dongle	1
27	004944	1/4" compression plugs	4
28	044548	Replacement o-rings for slip-on cap	2
29	123632	9 pin extension cable	2
29a	108258	Optical Isolator	1
30	129698	Gas console power cord	1
31	024710	Hose assembly: 3/16 inch right hand to 3/16 inch left hand	2
32	024711	Hose assembly: 3/16 inch right hand ‘A’	6
33	024162	Coolant loop-back hose: 1/2 inch #8	2

Parts list – Items 34-40







Item	Part Number	Description	Qty
34	128588	Adapter: Left hand ‘A’ male to right hand ‘A’ female	4
35	220002	Ignition testing: Cap	1
36	220003	Ignition testing: Nozzle	1
37	220004	Ignition testing: Electrode	1
38	128604	Ignition testing: Torch receptacle	1
39	804010	RoboTester instruction manual	1
40	001782	RoboTester tool box (not shown)	1